

POPULAR SCIENCE

MONTHLY
Mechanics & Handicraft

February
15¢

SEE
PAGE
96

IN THIS ISSUE:

**Mile-a-Minute
Model Cars**





\$6⁴⁵
Less
Grinder

The Drill Press attachment converts the famous Heavy Duty Hand Grinder into a sensitive type Drill Press that is ideal for the Model Maker or Master Craftsman. Drilling, routing, veining and many other operations may be accomplished with ease and precision. Its rigid and practical design and the large, machined and ground working surfaces of the table and base insure production of speedy and accurate work—and there is plenty of power in the Hand Grinder so you don't need to worry about stalling.

\$21⁹⁵

Kit
Complete
with Case



The Grinder Kit pictured above sets a new standard for usefulness and genuine economy. It features the Famous Heavy Duty Grinder and a hand picked assortment of twenty-eight of the most valuable cutters and other accessories, packed in a heavy guage, handsomely finished, steel box.



\$14⁹⁵

A COMPLETE MODEL MAKERS WORKSHOP *Featuring* AMERICA'S FINEST AND MOST DISTINGUISHED HAND GRINDERS

Here for the first time you have a complete practical set of accessories and a power unit for driving that enables you to do any type of model making. Power, delivered in abundance by the Heavy Duty Grinder, makes it possible for you to use the complete Model Makers Workshop in a confined space—with positive assurance that you can do precision work. Send your order today or write for full information.



\$9⁹⁵

Here is the Famous 3049 Heavy Duty Grinder—universally acclaimed by users everywhere as the most powerful, speediest and smoothest running Grinder for all types of work. With the new accessories listed here a new field is opened to Model Makers and Craftsmen—makes wood turning, drilling, routing, shaping, carving and many other operations easy to accomplish. Better results are obtained faster and easier.



\$5⁴⁵ Less
Grinder

The Lathe pictured above using the Heavy Duty Grinder has plenty of power to do real work—In fact you'll be amazed to see how you can take full size cuts without stalling it. It's ideal for all types of Model Making. An unlimited variety of parts such as masts, spokes, wheels, pulleys, etc. can be turned to size with speed and precision. The high speed provides smooth finished cuts on wood or plastics.

The Streamline Grinder is ideal for free hand use. It's light in weight—only 12 ounces—compact and fits the hand perfectly. The design and perfect balance make it ideal for doing fine, delicate work without tiring your hand. The abundance of speed produces a clean, finished cut and the power—17 watts output—eliminates the constant aggravation of stalling. It's tops for all around work and those "hard to get at" places.

DURO METAL PRODUCTS CO.
DEPT. HH2-2649 N. KILDARE AVE. CHICAGO, ILL.



You've hoped for it! Now the day has come!

*The Harvard Classics at a price per volume
 $\frac{1}{3}$ the cost of popular fiction!*

YES! It's absolutely true! Now you can own DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS at a price per volume $\frac{1}{3}$ the cost of current popular fiction! Never before in the history of these world-famous books have they been offered at a price so low!

DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS (THE HARVARD CLASSICS)

Dr. Charles W. Eliot, president of Harvard University for forty years, made it a vital part of his life's work to assemble this superb library. As he himself has said, "IN THESE BOOKS ARE THE ESSENTIALS OF A LIBERAL EDUCATION". The present price places DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS within the reach of every aspiring person in America!

HERE IS THE GREATEST BOOK BARGAIN EVER OFFERED

In this magnificent library are gathered the greatest writings, the cream of the genius of mankind. Buying these treasures separately would cost a staggering sum! Brentano's, one of the largest firms of retail booksellers in the world, recently stated that for only the partial contents of The Harvard Classics, in ordinary cloth-bound editions, the cost would be \$402.00! Yet you can have this marvelous set, beautifully printed, handsomely and uniformly bound, for less than 10% of that cost!

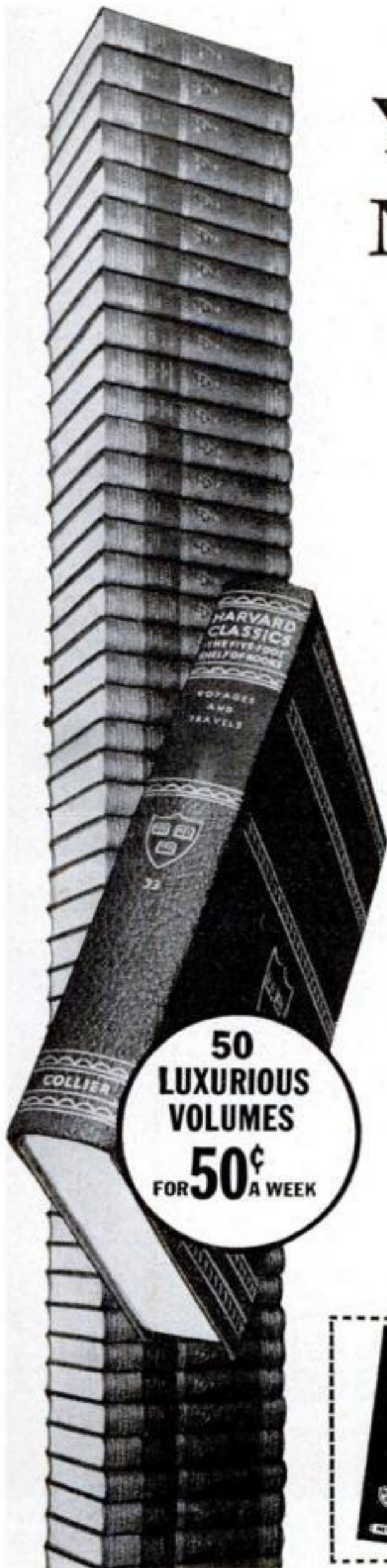
This beautiful new Library Edition of The Harvard Classics brings you the complete contents of DR. ELIOT'S FIVE-FOOT SHELF OF BOOKS. Every word, every line, every paragraph, every illustration is here! Included are the Daily Reading Guide and the unique General Index with its 76,000 entries guiding the reader to an acquisition of world culture—supplying the fundamentals of a college education.

OWN THESE FAMOUS BOOKS FOR FIFTY CENTS A WEEK

Take advantage of the most liberal terms ever offered in the history of these fifty incomparable volumes! For an initial payment as low as \$2.00 you may have this complete set delivered to your home with all shipping charges prepaid. **BUT YOU MUST NOT DELAY! THESE PRICES MAY HOLD FOR ONLY A LIMITED TIME. THEREFORE, WE URGE YOU TO ACT AT ONCE!**

THIS BEAUTIFUL BOOK FREE

The famous little book, "Fifteen Minutes a Day", furnishes you with full information about The Harvard Classics. It gives Dr. Eliot's own plan of reading—is packed with helpful, practical information! You really can't afford to miss owning this little gem of literature! It will be sent you free, postpaid and without obligation. Simply fill out and mail the coupon below.



THIS COUPON ENTITLES YOU TO FREE BOOKLET

P. F. COLLIER & SON CORP., 250 Park Avenue, New York
By mail, free and without obligation, send me the Booklet that tells about the most famous library in the world, Dr. Eliot's Five-Foot Shelf of Books (The Harvard Classics) and containing Dr. Eliot's own plan of reading. Also, please advise how I may secure the books by small monthly payments.

Mr. _____
Name Mrs. _____
Miss _____
Address _____

317 HCY

POPULAR SCIENCE

Founded 1872

MONTHLY

Volume 136, No. 2

Mechanics & Handicraft

RAYMOND J. BROWN, *Editor*

ARTHUR WAKELING, Home Workshop Editor

GEORGE H. WALTZ, Jr., Associate Editor

ALDEN P. ARMAGNAC, Associate Editor

SYDNEY OXBERRY, Art Editor

CONTENTS FOR FEBRUARY 1940

Mile-a-Minute Model Cars.....	61
Toothpick Engineering	70
Oddities from Ocean Jungles.....	73
Getting in Shape for Skiing.....	90
Roof-Top Trap Stores Sun's Heat.....	96
600 Miles an Hour.....	101
Merry-Go-Round Observatory	108
Finds Treasure in Peat Moss.....	112
Making of an Army Flyer.....	120
Ghosts of the Wild West.....	128
How Good Is a Used Car?.....	132

Features and Departments

OUR READERS SAY -	12
IDEAS FOR HOME OWNERS.....	32
THE MAN WITH THE NET	125
NEW HOUSEHOLD APPLIANCES.....	138
POPULAR SCIENCE QUESTION BEE.....	140
UN-NATURAL HISTORY	141
GUS WILSON'S MODEL GARAGE.....	142
AMATEUR PHOTOGRAPHY.....	167
NATIONAL HOMEWORKSHOP GUILD.....	183
ADVENTURES WITH YOUR MICROSCOPE	206
HOME-LABORATORY CHEMISTRY.....	209
RADIO DEPARTMENT.....	214
USEFUL HINTS FOR MOTORISTS.....	220



Planning to ski this winter? If so, you can prepare your muscles for the shock with home exercises pictured on page 90

AUTOMOBILES

Car Tests Reveal Static Secrets.....	82
Ski Rack Fits on Running Board.....	107
Latch for Overhead Garage Door.....	220
Choke-Rod Return Spring.....	220
Wall Mark Shows Backing Limit.....	220
Separate Hot-Water-Heater Pump.....	222
Rubber Strips Plug Tire Casings.....	222
Drilling Holes in Radiator Hose.....	224
Hydrometer Serves as Spray Gun.....	224
Temporary Hose Repair.....	224

AVIATION

Fire Fighters Use Parachutes.....	83
---------------------------------------------------	--------------------

(Continued on page 4)

[THE HOME WORKSHOP begins on page 145](#)

Published monthly at 353 Fourth Avenue, New York, N. Y., by Popular Science Publishing Co., Inc. Godfrey Hammond, President and Treasurer; R. C. Wilson, Vice President; Raymond J. Brown, Vice President; F. W. Briggs, Secretary. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter at Dayton, Ohio. Entered as second-class matter at the Post Office Department, Canada. Printed in U.S.A. Copyright, 1939, by Popular Science Publishing Co., Inc. All rights reserved in the United States, Great Britain, and in all countries participating in the International Copyright Convention and the Pan American Copyright Convention. Single copy, 15 cents. Yearly subscriptions to United States, its possessions, and Canada, \$1.50; foreign countries, excepting Canada, \$2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In presenting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. To avoid liability for patent infringement, readers should investigate before making, using, or offering for sale any of the devices, machines, or processes described; Popular Science Monthly takes no responsibility. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.

PRICE SMASHING SALE!

LATE MODEL • WORLD FAMOUS

TYPEWRITERS

Less than $\frac{1}{2}$ MFRS. ORIG. PRICE



BUY DIRECT FROM ME and SAVE OVER ONE-HALF



Act now—if you want to get the **GREATEST BARGAINS EVER OFFERED** in late model standard office size world famous typewriters. My **DIRECT-TO-YOU** plan brings you these late Standard make typewriters at **SENSATIONAL LOW PRICES**—at less than $\frac{1}{2}$ Mfrs. orig. price. Some even as low as \$26.90—less than $\frac{1}{2}$ mfrs. orig. price! Because I deal Direct With You—I give you **TREMENDOUS SAVINGS** on whatever standard make late model typewriter you choose.

ALL STANDARD MAKE LATE MODEL TYPEWRITERS!

Think of it!—you get typewriters that cost up to \$110.00 for less than $\frac{1}{2}$ the mfrs. orig. price—with amazing savings up to \$72.60. **UNDERWOOD—ROYAL—REMINGTON—L. C. SMITH—WOODSTOCK.** All with up-to-date features and **FULLY GUARANTEED.** Completely Refinished and Rebuilt with many late improvements. Do not confuse these fine late office size typewriters with old, inferior models or portables. I ship you only **GUARANTEED** Late Model Standard make machines at new **sensationally LOW ROCK BOTTOM PRICES.** I TAKE ALL THE RISK on my 10 day No Money Down trial Plan—the typewriter you select must sell itself on straight merit test and you are the sole judge.

OVER 200,000 SATISFIED CUSTOMERS BOUGHT FROM ME

Through the same Golden Rule Policy I offer you—the Ten Day Trial, No money down, **MONEY BACK GUARANTEE**—and shipment on approval. I have served over 200,000 customers all over the world. I give the savings of my direct-to-you plan to you, my customer. You can buy with confidence on my Personal Money Back Guarantee, backed by over a quarter-million assets.

SEND COUPON NOW WHILE STOCK IS COMPLETE

Don't buy a typewriter until you get my **FREE BIG COLOR CATALOG** showing all late standard make typewriters at amazing smashed prices! **NO OBLIGATION**—it costs nothing to see—so fill out coupon and mail today. **INTERNATIONAL TYPEWRITER EXCHANGE, 231 W. MONROE ST., CHICAGO, ILL.**

FREE!

ROLL-AWAY-SECRETARIAL TYPEWRITER STAND



Yours **FREE** with typewriter you select on this price smashing sale. Makes every typewriter portable. Can be moved by touch of finger. Strong, compact, rigid, attractive, light weight. Ask for details.

10 DAY TRIAL

No Money Down

EASY TERMS—50c^a week

MONEY BACK GUARANTEE

Yes, I mean it! I will ship your choice—**UNDERWOOD, ROYAL, REMINGTON, L. C. SMITH or WOODSTOCK**—at my own risk so you can try it in your own home or office for 10 days. *Don't even pay one cent down*—the typewriter comes to you strictly on approval. You are the sole judge—no salesman, no pressure—no obligation to buy. When you have thoroughly convinced yourself that you have the biggest value ever offered then say, "I'll buy." Use easiest terms yet—as little as 50c a week (only 8c a day) or \$2.00 a month!

FREE —Complete VAN ZANDT TOUCH TYPING COURSE!

I give you **FREE** this famous Home Study Course. Learn to type quickly and easily. **SEND COUPON** below for all details and **BIG FREE CATALOG** in natural colors **NO OBLIGATION**—Mail Coupon today!

SEND COUPON FOR BIG FREE CATALOG!

Mr. W. F. Clausung, President,
INTERNATIONAL TYPEWRITER EXCHANGE
231 W. Monroe St., Chicago, Illinois. Dept. 207

Please send **WITHOUT OBLIGATION** complete Illustrated **FREE CATALOG IN COLORS**, showing late model Standard **TYPEWRITERS** at tremendous savings, with no money down and 10 day Trial. Also Free Stand and Touch Typing course offer.

Name _____
Address _____
Town _____ State _____

CONTENTS [Continued]

Planes on Noses Save Space.....	106
Airplane Is Cosmic-Ray Laboratory....	107

HELPS FOR HOME OWNERS

Fertilizer Shot into Soil.....	32
Kit Has Tools for Home Repairs.....	32
Wall-Board Joint Hides Nails.....	34
Fire Alarm for the Home.....	34
Questions from Home Owners.....	36

HOUSEHOLD AIDS

Holder for Toothbrushes.....	138
Ferris-Wheel Shoe Rack.....	138
Stand Makes Kneeling Easier.....	138
Slicing Plate Serves Sausages.....	138
Dial Sets Speed of Mixer.....	139
Brush Cleans Slender Vases.....	139
This Flatiron Is Round.....	139
Pot Holds Tea and Water.....	139
Hanger for Small Belongings.....	139

NEW INVENTIONS

Visor Snaps on Ski Cap.....	68
Double Brush Is Shooehorn, Too.....	68
Toy Submarine Dives and Rises.....	69
Fireproof Gloves for Camp and Home	69
Television Eye Shows Sun's Corona....	81
Crane Car Speeds Up Track Laying....	82
Novel Manicure-Set Holder.....	84
Kit for Carving Plastics.....	84
Spray for Protecting Trees.....	85
Handle Opens New Knife.....	85
Cone Speaker in Toy Phonograph.....	94
Light Motor for Bicycle.....	99
Spillproof Necktie Rack.....	100
Keeps Poison Gas from Food.....	110
Self-Cleaning Comb Curls Hair.....	111
Traveling Case for Bottles.....	115
Portable Water-Filtering Plant.....	117
Loops Hold Ski-Cap Visor.....	118
Knife Is Holder for Key.....	119
Storage Flash-Light Cell.....	125

PHOTOGRAPHY

Midget Photoflash Bulbs.....	88
Films Form Bookless Library.....	115
Camera Catches Shells' Flight.....	116
Meter for Color Film.....	126
Miniature Contact Printer.....	126

Walking Stick Becomes Tripod.....	126
Handy New Copying Stand.....	127
Movie-Editing Desk Set.....	127
Rack Holds Single Film.....	127
Album for Transparencies.....	127
Tricks in Using Roll-Film Tanks.....	167
System for Keeping Photo Record.....	168
Movie Camera Wheeled on Dolly.....	170
Focusing Sharply with Dim Light.....	170
Roller Covered with Blotter.....	170
Cut-Outs Prop Up Book Ends.....	171
Blocking Part of a Negative.....	171
Pockets Sewed in Focusing Cloth.....	171
Sling Strap for Large Cameras.....	172
Rubber Band Holds Lens Cap.....	172
Lighting for Copying Work.....	172
Nonslip Surface for Folders.....	179
Corners Hold Titles in Album.....	195
Camera Base for Table-Top Shots.....	234
Cover Keeps Hypo Free of Dust.....	236
Diaphragm Fades Movie Scenes.....	236

UNUSUAL FACTS AND IDEAS

Air Gun Delivers Concrete.....	68
Wires His Campus for Sound.....	84
Numbers Mark Soldiers in Training....	85
Diver Feeds Fish.....	86
Novel Christmas-Tree Village.....	87
Gas-Station Men Wear Roller Skates..	88
"Paddle-Wheel" Television Aerial.....	89
How To Get Fleas from a Grizzly.....	89
Hoop Marks Milestone for Train.....	95
He's Never Caught Without a Pencil..	95
Are You Having Any Fun?.....	98
Headlines Are Made to Order.....	100
Novel Trap Electrocutes Ants.....	100
Service Breaks In New Shoes.....	105
Aid Shows Refrigerator Savings.....	105
Targets Train Antitank Gunners.....	106
Big Retort Built for Movie.....	110
Pits Conceal Antitank Guns.....	111
Liquor Flavors Growing Melon.....	111
Fashion Plates Adopt Armor Plate.....	115
Cows Get Radiation Treatment.....	116
Hides Secret of "Death Ray".....	117
Smoke Tests Guide Sailboat Design....	118
Bike Gives Second-Story Ride.....	119
Gasproof Canary Carrier.....	125
His Roof Is a Rock.....	136

(Continued on page 6)

**In This Issue—Hundreds of Fascinating Articles Tell the Latest News of
Laboratory Discoveries, Scientific Triumphs, and Amazing New Inventions**

"I WAS TRAPPED IN A BLAZING INFERNO!"

A true experience of MRS. LILLIAN POKEDOFF, Brooklyn, N. Y.



"AN OMINOUS, CRACKLING NOISE awoke me the first night I was visiting in a strange farmhouse," writes Mrs. Pokedoff. "Choking and coughing from smoke, I groped for the bedroom door and staggered out into the hall."

"IN THE THICK, BILLOWING SMOKE I couldn't locate the stairway. Then I heard a muffled shout from below and a beam of light bored through the darkness, showing me the way to safety."



"I STUMBLED DOWN THE STEPS just in time—for a kerosene tank exploded and the house burned to the ground! I sincerely say that I owe my life to those powerful and dependable 'Eveready' fresh DATED batteries!"

(Signed) (Mrs) Lillian Pokedoff



FRESH BATTERIES LAST LONGER... Look for the DATE-LINE

NATIONAL CARBON COMPANY, INC., 30 EAST 42nd STREET, NEW YORK, N. Y.
Unit of Union Carbide and Carbon Corporation

Try this cooler SHAVING CREAM at our expense • 20 SHAVES FREE

We won't ask you to read a lot of weighty arguments aimed to convince you that Listerine Shaving Cream is superior to others. We'll rest our case on the cream itself. We want you to try it at our expense.

One little dab of it on the face, whipped into a cool, creamy lather, will do more to convince you of its merit than a whole page of arguments.

If twenty free shaves do not remove all doubts of its superiority, nothing will.

It has been our experience that when a man gives Listerine Shaving Cream a thorough trial, he rarely returns to other brands—good as they may be. Possibly you will be an exception. We hope not.

It costs you nothing to learn the secret of cooler, quicker shaving. Simply clip the coupon below and put it in the mail. Tear it out now before you forget it. In return for it, you will receive a generous trial tube of Listerine Shaving Cream—enough for at least twenty shaves.

When that tube is empty, you will probably want the regular size tube. What a whopper of a tube it is . . . containing at least 130 shaves! Some men get as much as 175. What a whale of a bargain at 35¢!

All drug counters have it, as well as the new Listerine Brushless Cream. LAMBERT PHARMACAL CO.



Lambert Pharmacal Co., Dept. 152, St. Louis, Mo.

Please send me free and postpaid your large sample tube of ☐ Listerine Shaving Cream; ☐ Listerine Brushless Cream. (Check whichever is desired.)

Name _____

Address _____

City _____ State _____

CONTENTS [Continued]

CRAFTWORK

Jig-Sawed Archer Guards Tray.....	153
Small Leaf-and-Blossom Tray.....	161
How to Make Shepherds' Pipes.....	162
Neckerchief Slides for Scouts.....	166
Tiny Chair Serves as Sewing Box.....	176
Large Medal Displayed in Plaque.....	177
Disney's Model of <i>Pinocchio</i>	180
Colorful Little Desk Clock.....	182
Hang-Up Anchor-Shaped Lamp.....	192
A Dinner Gong from Brass Pipe.....	195
Ski Jumper Ornaments Snow Suit.....	229

HINTS FOR THE HANDYMAN

Cork Utilized as a Shaker Top.....	153
Lubricating Soldering-Iron Tip.....	153
Ideas for the Shipshape Home.....	154
Set-Up for Sharpening Skates.....	156
Slot Holds Screws on Driver.....	156
Keeping Down Dust in the Shop.....	156
Clock Closes Bedroom Window.....	156
Ski Carriers Fastened to Auto.....	158
Shoe-Polishing Case in Wall.....	160
Reading Star Charts at Night.....	161
Chair Tip Acts as Hook Latch.....	166
Removing Printing from Plastics.....	166
Pencil Holds Thread for Mending.....	166
Electric Iron Kept in Closet.....	166
Lumber Rack for Small Truck.....	173
Safe Grip on Bits of Solder.....	173
Rubber Band Protects Socket.....	173
Knurled Roller Protects Check.....	173
Giant Dividers Measure Acreage.....	177
Heat Renews Old Carbon Paper.....	177
Metal Dust Visor for Register.....	177
Wooden Handle Attached to File.....	178
Pliers Force Brads into Frame.....	178
Skagway Scow Scoots on Snow.....	178
Drawing Board for Stenciling.....	179
Cork on Bit Acts as a Gauge.....	179
Hand Tools for Special Purposes.....	186
Acid Solution Cleans Filter.....	190
Fiber Washers Cut from Fuses.....	190
Simple Outfit for Ice Fishing.....	190
New Inner Soles for Work Shoes.....	190
Altering Outside Window Shades.....	192
Old Ribbon Acts as a Stamp Pad.....	193
Wire Wrapping for Soldering Iron.....	195
Substitute for Hollow Rivets.....	195
Well-Boring Outfit Costs Little.....	198
Old Tire Keeps Gate Closed.....	212
Hints on Better Jig-Sawing.....	213
Tire Casing Reduces Vibration.....	213
Photo Reflector Acts as Oven.....	213
Shop Sayings of Old Bill.....	228

HOME LABORATORY

Stones under the Microscope.....	206
Weights Hold Cover Glasses Down....	208
Oil Refinery for Home Chemists.....	209

(Continued on page 8)

what will you be doing



MAN, there's no sense in drifting along at the same old dull, drab job! You've got one life — that's all. What you make of it is your business — but if you want to make a success of it, it's time to get going!

Listen. Some of the biggest men in this country were in your shoes once. But they knew one thing! They knew that it takes training—TRAINING—to succeed in this

world! And they got that training through the I. C. S.!

100,000 ambitious men are enrolled with the International Correspondence Schools right now. They're going places! They're getting sound, essential TRAINING by a method based on up-to-date textbooks, personal instruction, and sound vocational guidance. Here's the coupon they mailed!

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 7676-J, SCRANTON, PENNA.



Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X:



TECHNICAL AND INDUSTRIAL COURSES

- | | | | | | |
|---------------------------------------------------|---------------------------------------|----------------------------------------------------|---------------------------------------------------|----------------------------------------------------|----------------------------------------|
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Air Brake | <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Marine Engines | <input type="checkbox"/> R. R. Signalmen's | <input type="checkbox"/> Refrigeration |
| <input type="checkbox"/> Air Conditioning | | <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Mechanical Drafting | <input type="checkbox"/> Sanitary Engineering | |
| <input type="checkbox"/> Architectural Drafting | | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Sheet Metal Work | |
| <input type="checkbox"/> Architecture | | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Mine Foreman | <input type="checkbox"/> Steam Electric | |
| <input type="checkbox"/> Auto Engine Tune-up | | <input type="checkbox"/> Fire Boilers | <input type="checkbox"/> Navigation | <input type="checkbox"/> Steam Engines | |
| <input type="checkbox"/> Auto Technician | | <input type="checkbox"/> Fruit Growing | <input type="checkbox"/> Patternmaking | <input type="checkbox"/> Steam Fitting | |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Heating | <input type="checkbox"/> Pharmacy | <input type="checkbox"/> Structural Drafting | |
| <input type="checkbox"/> Bridge Engineering | | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Poultry Farming | <input type="checkbox"/> Structural Engineering | |
| <input type="checkbox"/> Building Estimating | | <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Plumbing | <input type="checkbox"/> Surveying and Mapping | |
| <input type="checkbox"/> Chemistry | | <input type="checkbox"/> House Planning | <input type="checkbox"/> Practical Telephony | <input type="checkbox"/> Telegraph Engineering | |
| <input type="checkbox"/> Civil Engineering | | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Public Works Engineering | <input type="checkbox"/> Textile Designing | |
| <input type="checkbox"/> Coal Mining | | <input type="checkbox"/> Machinist | <input type="checkbox"/> Radio, General | <input type="checkbox"/> Textile Designing | |
| <input type="checkbox"/> Concrete Engineering | | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Radio Operating | <input type="checkbox"/> Toolmaking | |
| <input type="checkbox"/> Contracting and Building | | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Radio Servicing | <input type="checkbox"/> Welding, Electric and Gas | |
| | | <input type="checkbox"/> Manufacture of Pulp Paper | <input type="checkbox"/> R. R. Section Foreman | <input type="checkbox"/> Woolen Manufacturing | |

BUSINESS COURSES

- | | | | | | |
|--------------------------------------------------|--------------------------------------|----------------------------------------------|-----------------------------------------------|-------------------------------------------------------|--------------------------------------|
| <input type="checkbox"/> Accounting | <input type="checkbox"/> Advertising | <input type="checkbox"/> Civil Service | <input type="checkbox"/> First Year College | <input type="checkbox"/> Railway Postal Clerk | |
| <input type="checkbox"/> Bookkeeping | | <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Secretarial |
| <input type="checkbox"/> Business Correspondence | | <input type="checkbox"/> Commercial | <input type="checkbox"/> French | <input type="checkbox"/> Service Station Salesmanship | |
| <input type="checkbox"/> Business Management | | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Grade School | <input type="checkbox"/> Sign Lettering | <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Cartooning | | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> High School | <input type="checkbox"/> Traffic Management | |
| | | | <input type="checkbox"/> Illustrating | | |
| | | | <input type="checkbox"/> Lettering Show Cards | | |

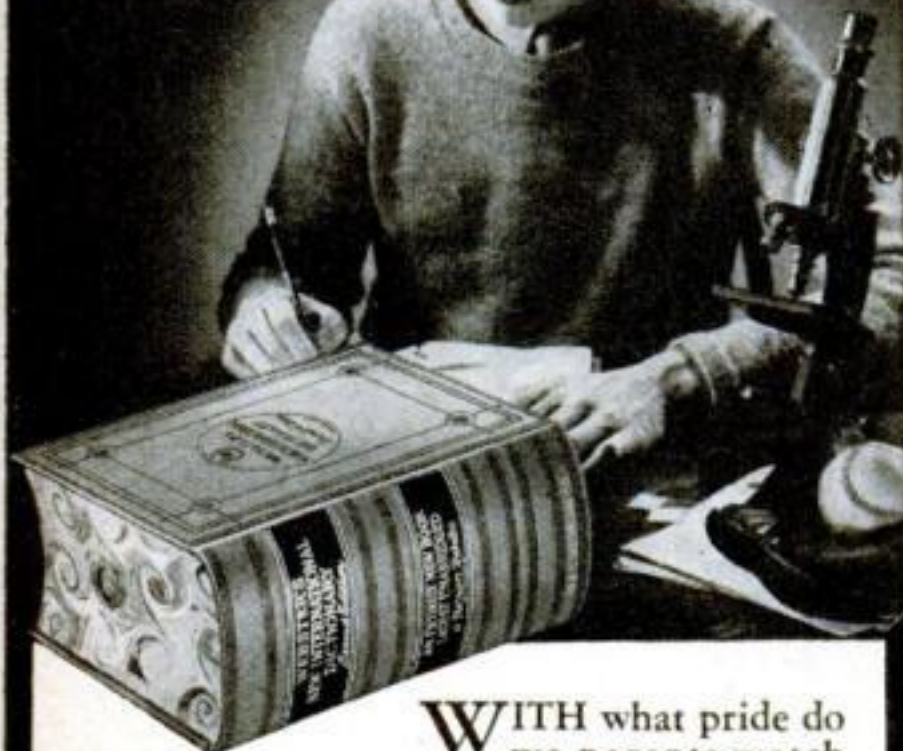
DOMESTIC SCIENCE COURSES

- | | | |
|-----------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Home Dressmaking | <input type="checkbox"/> Tea Room and Cafeteria |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Professional Dressmaking and Designing | <input type="checkbox"/> Management, Catering |

Name..... Age..... Address.....
 City..... State..... Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada
 British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

Success in Life Begins at Home



WITH what pride do we parents watch the developing characters and aspirations of our children! How glad we are to encourage them and to supply dependable sources of information for their growing minds! That is why Webster's New International Dictionary, Second Edition, is a prized possession in so many American homes where there are young people. Why not give your child the great benefit of this universal question-answerer?

Put the NEW MERRIAM-WEBSTER where your children can use it every day!

In its 3350 pages the New Merriam-Webster offers a wealth of information on nature, literature, art, history, aviation, radio, astronomy, chemistry, business, and thousands of other subjects. It is the only new unabridged dictionary in 25 years. Try it on the NEW WORDS—such as dust bowl, pickaback plane, perisphere, swing music, etc. Any bookdealer or stationer will be glad to show it.

Write for free, illustrated booklet, "The New Merriam-Webster: What It Will Do For You." G. & C. Merriam Company, Dept. 382, Springfield, Massachusetts.



Look for the Circular Trade-Mark
It Identifies the Merriam-Webster

WEBSTER'S NEW INTERNATIONAL DICTIONARY Second Edition

CONTENTS [Continued]

MODELS

Fans Run Big Model Railway.....	85
Pickaback Cuts Aerial Capers.....	94
Scale Model of a Bandwagon.....	99
Kits Trace Railroad History.....	107
Tiny Electromagnet Loads Train.....	165
Pelican Carved in Three Poses.....	194
Scale Model of "Unitwin Vega".....	196
Simple Plane for Model Makers.....	202

NEW SHOP IDEAS

Drive Wrench for Close Quarters.....	152
Mounting Data on Bulletin Board.....	191
Aids in Truing a Lathe Chuck.....	199
Sharp Pipe Cuts Hole in Wall.....	200
Mounting for Hack-Saw Blade.....	201
Leather Grip on Hammer Handle.....	201
Holdfast Speeds Up Bench Work.....	201
Cold Solder Glues Up Pads.....	201
Release on Reel Regulates Line.....	202
Gas Furnace Melts Soft Metals.....	203
Pick-Up Retrieves Small Parts.....	203
Workmanlike Knurling in a Lathe.....	204
How to Bore Holes in Porcelain.....	204
Heavy-Duty Shop Stand of Wood.....	205
Carrier Handles Steel Drums.....	205
Fastening a Drill-Chuck Key.....	205
Ellipsograph Draws Perfect Ovals.....	212
Thin Cement Repairs Articles.....	212
Depth Gauge for the Drill Press.....	212

SHOP DATA FILE

Finish for Dresser Drawers.....	161
Lighting Photo Copy Work.....	172
How to Sharpen Auger Bits.....	178
Number of Wires in Conduits.....	179
Speeds of Woodworking Machines.....	190
Selection of Grinding Wheels.....	205

WOODWORKING

All-Purpose Family Runabout.....	146
Cutting Delicate Inlays.....	152
Rope-of-India Smoking Stand.....	152
Shaper Cutters Used for Turning.....	153
Portable Case for Drafting Kit.....	157
Three Hanging Bookshelves.....	159
Make-Up Chest for a Girl's Room.....	174
Drawers Improve Tool Boxes.....	176
Table-Tennis Table with Pipe Legs.....	191
Pony Toy Operated by Pedals.....	193
Record Player Placed in Box.....	202

RADIO

Round-the-World Radio.....	214
Volume-Control Replacement Kit.....	218
New Tester Works Automatically.....	218
Air-Spaced Trimmer Condenser.....	218
Radio and Phonograph in Tables.....	219
Blinker Tells if Battery Is On.....	219
Radio Laboratory on Wheels.....	219



Plan Your Future

Choose Your Field NOW For Success

Will you master fate or will fate master you? That's a question deserving your honest answer . . . right now! Actually it is largely up to you. You can do with Life almost what you will. LaSalle will help you establish yourself for real success by providing you with the comprehensive, specialized training for which it is so famous. Choose your field . . . now! Check the coupon below for the free booklet you want us to send you. It can be your first step toward assured success.

Opportunities in Traffic Management

The field of Traffic Management offers real opportunity only to the man who knows. Spare time study and the will to succeed have pushed scores of Traffic employees up the ladder to financial success. Many LaSalle-trained traffic managers—both in the railroad and industrial field—now command salaries of \$3,000.00 to \$5,000.00 a year—and better. Investigate. Find out how you can qualify for these higher positions through LaSalle home-study and guidance.

Law for Business Success

And it isn't necessary to practice law to get this Success. In fact probably most of the men who study law today have no idea of taking the bar examination or becoming lawyers—they want law training to give them mastery of men and situations in business. You know that—

- (1) the man with legal training is a leader—not a follower.
- (2) legal training keens your mind—clears away the problems that stump the ordinary fellow and makes you master instead of man.
- (3) knowledge of law simplifies the complications of executive work.
- (4) Many top executive places are filled by men who have studied law.

No matter whether you are in a big corporation or a small business—in a great city or a little town—a practical knowledge of law cannot fail to be of real and vital help to you in making a more successful career.

In every state in the union you'll find law-trained men who came up through LaSalle. What others have done, you can do.

And LaSalle offers either a full law course leading to LL. B. or a shorter business law training—whichever you prefer. All text material, including valuable 14-volume Law Library. Training comprises the most effective features of modern law instruction.

Executive Training

Executives who are efficient managers command responsible positions and good incomes. And the need for

trained executives is growing rapidly. We train you thoroughly at home in your spare time for every type of executive work—teach you the principles and practices used by our most successful business leaders and help you develop your management capacity—by a training built with the aid of outstanding executives.

Become an Expert Accountant The Profession That Pays

The demand for skilled accountants—men who really know their business—is increasing rapidly. New state and federal legislation requires much more, and more efficient accounting from business—big and small. Corporations are in constant need of expert counsel in matters relating to Auditing, Cost Accounting, Business Law, Organization, Management, Finance. Men who prove their qualifications in this important branch of business are rapidly promoted to responsible executive positions—given an opportunity to earn real salaries. The range is from \$2,000.00 to \$10,000.00 a year—even to higher income figures.

Under the LaSalle Problem Method you can at home acquire a thoro understanding of Higher Accountancy, master its fundamental principles, become expert in the practical application of these principles—this without losing an hour of work or a dollar of pay.

Your training will be under the direct supervision of a staff of legal, organization and management specialists, business efficiency engineers and Certified Public Accountants.

Preliminary knowledge of bookkeeping is unnecessary. We train you from the ground up, or from where you now are, according to your individual needs.

Mr. Salesman: What's Wrong?

Why aren't you making more sales—more money? Is it you—or your proposition? Check up first on yourself. Other men—no better than you—have found their earnings jump and stay up when they trained with LaSalle. Literally thousands of men—many of them years at the game—have increased their sales volume and earnings through home study with LaSalle guidance. Sound—practical—usable—right from field experience. Train for top-notch production with LaSalle.

LASALLE EXTENSION UNIVERSITY A CORRESPONDENCE INSTITUTION Dept. 283-R CHICAGO

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked.

- | | | |
|-----------------------------------------------|------------------------------------------------|--------------------------------------------------|
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Commercial Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Law: Degree of LL.B. | <input type="checkbox"/> Expert Bookkeeping | <input type="checkbox"/> Business Correspondence |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> C. P. A. Coaching | <input type="checkbox"/> Effective Speaking |
| <input type="checkbox"/> Modern Salesmanship | <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Stenotypy |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Modern Foremanship | |

Name _____ Age _____

Position _____ Address _____



HOW A "TIP" GOT TOM A GOOD JOB



J. E. Smith, President
National Radio Institute
Established 25 years

I will train YOU too at Home in Spare Time for Good Jobs in Radio

I Trained These Men



\$10 to \$20 Week in Spare Time
"I repaired many Radio sets when I was on my tenth lesson. I made \$600 in a year and a half, and I have made an average of \$10 to \$20 a week—just spare time."

JOHN JERRY,
1529 Arapahoe St.,
Denver, Colo.



Makes \$50 to \$60 a Week
"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N.R.I."

H. W. SPANGLER,
126½ S. Gay St.,
Knoxville, Tenn.



Operates Public Address System
"I have a position with the Los Angeles Civil Service, operating the Public Address System in the City Hall Council. My salary is \$170 a month."

R. H. ROODE,
R. 136, City Hall
Los Angeles, Calif.

Radio is a young, growing field with a future. It offers many good pay spare time and full time job opportunities. And you don't have to give up your present job, go away from home, or spend a lot of money to become a Radio Technician. I train you right at home in your spare time.

Jobs Like These Go to Men Who Know Radio

Radio broadcasting stations employ engineers, operators, technicians and pay well for trained men. Radio manufacturers employ testers, inspectors, foremen, servicemen in good-pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make \$30, \$40, \$50 a week. Others hold their regular jobs and make \$5 to \$10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio; loudspeaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many good jobs soon.

Why Many Radio Technicians Make \$30, \$40, \$50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year

Get Facts About THIS



millions of Radios get out of date and are replaced. Millions more need new tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities—opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred \$30, \$40, \$50 a week jobs of 20 years ago have grown to thousands.

Many Make \$5, \$10 a Week Extra In Spare Time While Learning

The day you enroll, I start sending you Extra Money Job Sheets which start showing you how to do Radio repair jobs. Throughout your course I send plans and directions which have helped many make \$200 to \$500 a year in spare time while learning. I send special Radio equipment to conduct experiments and build circuits. This 50-50 training method makes learning at home interesting, fascinating, practical.

Find Out What Radio Offers You

Act today. Mail coupon for my 64-page book, "Rich Rewards in Radio." It points out Radio's spare time and full time opportunities and those coming in Television; tells about my course in Radio and Television; shows many letters from men I trained, telling what they are doing and earning. Read my money back agreement. Find out what Radio offers you. Mail coupon in envelope or paste on penny postcard—NOW.

J. E. SMITH, President, Dept. 0BP3,
National Radio Institute, Washington, D. C.

THIS
Free Book
HAS HELPED
HUNDREDS OF MEN
MAKE MORE
MONEY



TESTED WAY TO BETTER PAY



I Also Give You This Professional Servicing Instrument...

Here is the type of instrument successful Radio Technicians use—an All-Wave Set Servicing Instrument. It contains everything necessary to measure A.C. and D.C. voltages and current; to check resistances; adjust and align any set, old or new. It satisfies your needs for professional servicing after you graduate—can help you make extra money fixing sets while learning.

GET THE FACTS,
MAIL THIS COUPON
NOW!



THIS COUPON GOOD FOR
ONE FREE COPY OF MY BOOK!

J. E. SMITH, President, Dept. 0BP3,
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Send me FREE, without obligation, your 64-page book "Rich Rewards in Radio" which points out spare time and full time opportunities in Radio, those coming in Television, and explains your 50-50 method of training men at home in spare time to be Radio Technicians. (Write Plainly.)

NAME.....AGE.....

ADDRESS.....

CITY.....STATE.....

Our Readers Say



\$100 IN PRIZES

How would you like to write one short letter that would bring you \$50 in cash? Here's your chance. All you have to do is write 300 words or less telling us what article, feature, or department in this issue of *POPULAR SCIENCE MONTHLY* you liked most and why. For the four best letters received before February 1, 1940, *POPULAR SCIENCE MONTHLY* will award a total of \$100 in cash prizes. The writer of the letter which in the opinion of the judges is the best will receive the first prize of \$50. The second best letter will be awarded \$25, the third best \$15, and the fourth best \$10. The editors of *POPULAR SCIENCE MONTHLY* will judge the letters, and their decisions will be final. In case of a tie, each tying contestant will be awarded the prize tied for. Address your letter to the Contest Editor, *POPULAR SCIENCE MONTHLY*, 353 Fourth Avenue, New York, N. Y. No entries will be returned, and all will become the property of *POPULAR SCIENCE MONTHLY*.

Some Long-Overdue Praise for an Unsung Hero

It's been said many times that the electromagnet is the most important contribution of science to modern living. Without it, for example, we'd have no electric generators no electric lights, radios, nor trains, few internal-combustion engines, in fact virtually none of the basic everyday conveniences we accept everywhere we turn. I'm writing, however, to offer humble gratitude to some unsung hero who devised another important scientific device that helps us get along no end. It's something that is used in two places in my furnace, once each in my household hot-water heater, electric iron, waffle iron, toaster, and refrigerator, and also in the cooling system and carburetor of my car. That's nine of them without even trying. The amount of work they save me is great, and all of them do a better job than I could if I spent twenty-four hours a day trying. Of course, there are other modern conveniences that we carelessly overlook, but this is an outstanding one. Know what I'm referring to? I wonder how many of your readers do.—W. D., Buffalo, N. Y.

(Continued on page 14)

Soppers of the World Arise! Down With This Sissy Stuff!

AN INTERESTING plea came recently from the secretary of the American Bakers Association to lift the stigma from the socially frowned-upon act of "sopping." Sopping,

he defines as "the practice of using a piece of bread to sop up gravy and the juices of vegetables and fruits." Long before eating utensils were invented, sopping was in good taste. As a sopper from way back, I feel that it is time for the soppers of the world to arise and do some sneering themselves at the tra-

YEAH, THEN WE'LL HAVE A FLOCK OF BOOKS ON HOW TO SOP, LIKE THE BALONEY ON WINE DRINKING!



dition breakers who first brought this noble and delightful pleasure to disrepute. When so-called polite society first eschewed sopping, it wasn't long before dunking and picking up the drumstick in your fingers went by the board, too. Nowadays, anyone who practices these eating habits does so at his own risk. Come on! Let's be realists and enjoy what's good to eat with the abandon of those wholesome hedonists the French, and with one accord dip our bread in the gravy, sop up all we can, eat it, and like it!—B. G., Boston, Mass.

Here's One To Keep You Lying Awake Nights

BEING, to the best of my knowledge, out of range of a television transmitter, I of course do not own a television receiving set. All I know about televising I've learned from the pages of your fine magazine. What I know of actual reception is second-handed to me from a friend who lives near New York. He has a receiver, and tells me occasionally by letter of some of the programs he gets. But what I'm writing about really is this: If a television camera were aimed so that its field of view just took in the front of a television receiver a few

WE'LL LET YOU KNOW WHEN WE GET THROUGH DINNER



Promotion Begins at Home

Pay Raises Depend Largely on What You Do in Your SPARE Time

If you are an average high school graduate, the average man with college grade vocational training earns \$25 a week MORE than you!

**Train at Home NOW
for a BETTER Job
TOMORROW!**

YESTERDAY—

In 1900 . . . Many doctors then practicing were not even high school graduates. High School had not been required at the time they entered medical school.



TODAY—



In 1940 . . . Schools of nursing require high school graduation because most of them are conducted at college level. Progress has made modern nurses' training equal or superior to that available to many old time doctors.



The Wright brothers, long months after they actually had accomplished flight, still were baffled by the problem of how to turn a plane while it was flying. (1904)

Thousands of schoolboys 14-16 years of age know more today about airplane design than the Wrights knew at Kitty Hawk.



In 1900 . . . The High School Graduate was a person of distinction. Only one person in 800 had finished high school.



In 1940 . . . More than a MILLION boys and girls completed high school. Graduates now are commonplace. High school is minimum educational requirement in most lines.



In 1900 . . . Very few even thought of going to college, unless to enter one of "the learned professions." The number of college graduates in business and industry was so few that they formed practically NO COMPETITION in the average job.



In 1940 . . . Almost exactly as many are being graduated from college, today, as from high school 40 years ago. Everywhere—in everything you do—in commerce, industry, personal affairs, you are up against the competition of COLLEGE GRADUATES.



In 1900 . . . The "little red school-house" did a pretty fair job of equipping men and women to make their way in the world.



American School, Dept. G-246, Drexel Ave. at 58th St., Chicago, Illinois

Gentlemen: I'll sit down and consider my Promotion Problems carefully if you will send me FREE information covering subject checked. No obligation.

- | | | |
|-------------------------------------------------|----------------------------------------------------|---------------------------------------------------|
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Radio and Television | <input type="checkbox"/> Business Management |
| <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Aviation |
| <input type="checkbox"/> Drafting and Design | <input type="checkbox"/> High School Course | <input type="checkbox"/> Electrical Engineering |
| <input type="checkbox"/> Liberal Arts | <input type="checkbox"/> Accounting and Auditing | <input type="checkbox"/> Electrical Refrigeration |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> Architecture and Building | <input type="checkbox"/> Business Law |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Automotive Engineering | <input type="checkbox"/> Retail Merchandising |

Name

Address

Our Readers Say (CONTINUED)

feet away and tuned to the transmitter, what would appear on the television receiver's viewing screen? A picture of itself? A blank? Can anyone tell me?—S. D., Norfolk, Va.

He Might Find It Easier To Change His Name

WHY doesn't some clever fellow think up a universal code for spelling out difficult names over the telephone? It is my misfortune to have a very unusual name, and to live on an almost unpronounceable street. When I have to give my name and address over the phone, it's a matter of saying "P as in PETER, T as in TOM," and so on. Sometimes the person at the other end doesn't catch the "Peter" and "Tom" either. What can I do then—spell them out?

I think it would help if everybody used the same words for this purpose. I suppose most people use PETER for P and TOM for T, but I can imagine a college professor saying "P as in POPOCATEPETL, T as in TRANSUBSTANTIATION." Let's get together and work out a simple system for everybody. We could call it the "TOM, DICK, and HARRY" System.—A. N., Milwaukee, Wis.

WHAT GOOD WOULD A CODE BE FOR A NAME FULL OF CONSONANTS LIKE PRZEMYSŁKIVITZKÓFF?



No One Got Gyped and Everybody's Happy

IN ANSWER to R. G. N.'s problem in the November issue, no one got gyped. All ended up even, and with all their debts paid and collected. Smith knew in the first place that it was a counterfeit bill he had found, so that he lost nothing when he burned it up.—D. R. V., Dorchester, Mass.

A Darkroom Is Only As Safe As Its Unsafest Safelight

BE IT dark, be it light, a darkroom is only as safe as its unsafest safelight. Thus, in answer to D.V.'s query as to what color the walls of his darkroom should be, it really makes no difference. Walls merely reflect light; they do not give off light. Thus, if no light enters the room, no harmful light can possibly be reflected from the walls. The same is true with the use of a safelight. If this is of an approved type and with no light leakage, any reflection from the walls, whether dark or white, would be unimportant. It might be well to add that most photographers, including Hollywood profes-

sionals, prefer the white walls.—A.D.C., Wrentham, Mass.

He Would Put the Bearskins on the Bare Skins

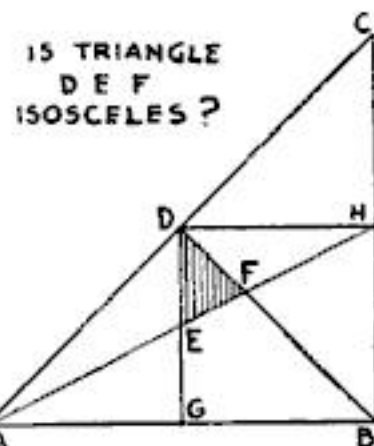
YOUR readers seem to be very much interested in the subject of bands, and to have very definite ideas about them. Not long ago, you published a very angry letter from a fellow who doesn't like bare-legged girl drum majors. Now I see a letter from L.R.N., Denver, Colo., finding fault with the new "fur coat" for covering wind instruments in cold weather. Why not settle the whole matter by putting the fur coats on the girl drum majors?

That ought to satisfy the fellow who doesn't like the bare legs, and also remove L.R.N.'s objection to muffling the horns. And it might be appreciated by the girl drum majors, too, on some of these winter days when cold breezes sweep down the streets.—A.M.E., Indianapolis, Ind.



"It Seems To Be So" Never Satisfied Euclid

How about giving the geometers another opportunity to stick their necks out? In the accompanying sketch, ABC is a right-angle isosceles triangle. Midpoint on the base AC is D, from which are constructed DG and DH parallel to CB and AB, respectively. Next, AH is constructed. It appears now to the unaided eye of the veriest child that triangle DEF is isosceles. Is it? How do you know? Can you prove your contention, if any?—W. E., Baltimore, Md.



An Introduction to Horner, for Which He Is Grateful

MAY I express my gratitude for the appearance of J.J.M.'s problem about the concentric spheres, for its solution acquainted me with Horner's method of evolving the root of a numerical equation—in this case a cubic equation. Solving for the radius of the sphere from two equations, I obtained by Horner's method the figure 55.8018 for the

(Continued on page 16)

**NOW... YOU CAN
ESTABLISH A
PERMANENT and
PROFITABLE
BUSINESS IN
YOUR OWN TOWN**

**... Plating
Gold, Silver, Cop-
per, Tin, Cadmium
and Nickel at Big
PROFITS!**

MAKE BIG MONEY AT HOME-*Electroplating*

*Amazing New Brush
and Tank Methods!*



Patented Warner System Based on New, More Profitable Methods!

WARNER engineering has now achieved the impossible! High capacity, professional plating equipment at amazing low cost! *No expert knowledge now necessary!* Combines both improved methods—brush and tank. Though priced low, it has capacity for producing more than \$12,000 volume per year. You invest only once for permanent, profitable, lifetime business. No job too big, no job too little for you to handle at a nice profit.

SMART OPERATOR CAN GET BACK INVESTMENT IN 2 WEEKS!

Warner Electroplating System pays for itself in double quick time. Everything's included... Super Power Pack, three Longlife Plating Tanks, Lectro Plating Brushes, Electric Polisher and Buffer, Automatic Electrically-Controlled Cleaning Tank, Anodes, Chemicals, etc. Nothing else to buy. You make good money on very first job!

Have you the vision to see and grasp a real opportunity? Are you capable of handling a proposition that can make you a prosperous business leader in your community? THEN—MAIL THE COUPON AT ONCE. Investigate—

learn the facts without obligation. Don't dream... *act now!* VALUABLE FRANCHISE IF YOU CAN QUALIFY!

**FREE
SAMPLE
PROVES
CLAIMS**

2 MINUTE DEMONSTRATION with SAMPLE AMAZES EVERYBODY!

Send today for FREE sample and interesting profit details and bona fide evidence of big, steady earnings.

Customers Galore... Every Home, Office, Factory, Shop and Store!

Today's demand for plating can support ten times present facilities. Making old articles new is an untouched field. W. R. Dixon, Kansas City, writes: "Made \$10.00 in 3 hours." A. M. Holland, Minneapolis, says: "Earned cost of plater first week." L. White, Perry, N. Y., states: "I've done 25 jobs so far." WARNER EQUIPMENT NOW USED BY BETHLEHEM STEEL CORP., U. S. NAVY, STANDARD OIL, COLUMBIA BROADCASTING SYSTEM, STATE OF MINNESOTA.

TEAR OUT-MAIL AT ONCE!

WARNER ELECTROPLATER CO.,
Dept. 2-T, 360 No. Michigan Ave.,
Chicago, Illinois

Please rush photos, facts, free sample and full information on "How To Make Money At Home—Electroplating." Also—details covering your License Agreement.

NAME.....

Address.....

City.....State.....

Our Readers Say (CONTINUED)

radius. Hence the circumference equals 350.613243549282—not being dead certain of the last few places of the decimal fraction. —M.K., Canton, Ohio.

If He Turns to Page 61 His Squawk Will Be Answered

BEING one of your constant readers since 1932—and I still have all the issues—I want to voice the opinion that your magazine has had nearly perfect articles all these years. Now that 1939 is nearly over, I feel called upon to squawk loud and long because you recently had such a small article on model racing cars. How about a real write-up on the subject? In Canada I have not heard much of them nor seen one. I am very much interested in this new sport, so how about it? Please tell Gus Wilson that his articles are tops with me.—L.B., Hamilton, Ontario.



But We've Yet To See the Magician Who Shows You How It's Done

TO BE frank with you, there is in this country a considerable number of men and women who, for one reason or another, have been interrupted in their school studies, but who are still deeply interested in mathematics. I

HECK, NOW I CAN'T
REMEMBER HOW!



am one of those. The mathematical problems in your magazine form the focal point as far as my interest is concerned. There is little satisfaction in reading a problem when one is denied the solution. It should be possible for you to furnish answers in subsequent issues. You probably do not realize the serious, dili-

gent effort that many of us put forth to solve these problems, as a matter of education and training. Even a magician shows his final result.—C.W.B., Duluth, Minn.

It's Easier for Readers To Hold and It Holds This Reader

THIS makes the second year I have been taking P.S.M. It is one of the finest magazines I have ever read. You should be congratulated for making the change in size. It's very much easier to read and hold than it formerly was. I wonder how many of your

readers really take time to think what a wonderful institution it really is? It has articles on subjects that the public never would hear about otherwise, and so many clever ideas that it stimulates the reader into having ideas of his own.—R.P.S., Iron, Minn.

What Makes Frost Appear When the Air Isn't Freezing?

EVERYBODY knows that frost is frozen dew. But I've noticed that frost often appears on the ground on fall and winter mornings when thermometers indicate the temperature is well above freezing. Of course, sometimes the ground is cold enough to freeze the low-lying moisture, even though the air is not cold enough to freeze it. But this can't very well be so in the fall before the ground has had time to lose its store of summer heat.

YEAH, AND HOW ABOUT
THE FROST ON A
COCKTAIL SHAKER?



In fact, on a fall morning, I checked with several neighbors as to the reliability of my thermometer, which had read thirty-seven degrees F. as the sun came up across my frost-covered lawn. Each reported his thermometer had shown about the same temperature as mine at about the same time. Now I'd like some one to explain to me why the dew on the lawn froze when the temperature was above the freezing point. How about it?—A.M.J., Dayton, Ohio.

Turtles Aren't So Dumb: Remember the Hare and the Tortoise Fable

IN REGARD to the turtle trap that Mr. Lucas uses to catch turtles around Long Island, N.Y., the gentleman is credited with being public enemy No. 1 of snapping turtles. I wonder how long it took him to train 19,000 turtles to do the goose step in order to get into the trap. Perhaps the turtles do pin wheels to untangle their long claws. I never imagined that there were 19,000 turtles on Long Island that were smart enough to know how to get around the "guide lines" and into the trap. However, it was the most interesting story I've read in a long time. Some one with imagination like Frank Buck could make a lot of money with one of those turtles.—G.C., Hollis, N.Y.

HOWDY, FOLKS



IMAGINE THEIR JOY WHEN THEY FOUND THEY COULD PLAY

This easy-as-ABC way!



LEARNED QUICKLY AT HOME

I didn't dream I could actually learn to play without a teacher. Now, when I play for people they hardly believe that I learned to play so well in so short a time. *H.S.C., Calif.



SURPRISED FRIENDS

My friends are surprised at the different pieces I can already play. I am very happy to have chosen your method of learning. *B. F., Bronx, N. Y.



PLAYS ON RADIO

I am happy to tell you that for four weeks I have been on the air over our local radio station. So thanks to your institution for such a wonderful course. *W. H. S., Alabama.

What Instrument Would You Like to Play?

JUST name your instrument and we'll show you how you can learn to play it—quickly, easily, in spare time at home. Never mind if you don't know one note of music from another—don't worry about "special talent". And forget all you've ever heard about music's being hard to learn.

The truth of the matter is that *thousands now play who never thought they could!* Yes, men and women everywhere have discovered this amazingly easy way to learn music at home. Now they are enjoying the thrilling satisfaction of playing the piano, violin, guitar, saxophone or other favorite instruments. Some of them are playing in orchestras and over the radio; others are teaching music, making money in spare or full time. And thousands are having the time of their lives playing for their own enjoyment and the entertainment of their friends.

LEARN TO PLAY BY NOTE

Piano Guitar
Violin Saxophone
Organ Mandolin
Tenor Banjo
Hawaiian Guitar
Piano Accordion
Or Any Other Instrument

No tedious study and practice, no tiresome exercises. You learn to play *by playing*—start right in with the melody of a simple tune! It takes only a few minutes a day; the cost is trifling. Does it sound too good to be true? Mail the coupon and get the FREE PROOF!

FREE PRINT AND PICTURE SAMPLE

Fascinating illustrated booklet answers all your questions; free Print and Picture Sample shows how method works. If interested, mail coupon. (Instruments supplied when needed, cash or credit.) *Actual pupils' names on request. Pictures by professional models. U. S. School of Music, 82 Brunswick Bldg., N. Y. C., N. Y.

U. S. SCHOOL OF MUSIC

82 Brunswick Bldg., New York City, N. Y.

I am interested in music study, particularly in the instrument indicated. Please send me your free illustrated booklet, "How to Learn Music at Home" and the Free Print and Picture Sample.

Name.....

Address.....

Instrument..... Have you Instrument?.....

If you could have stepped into this picture



...YOU would be building giant transports NOW



If you could have stepped into this picture you would have joined a group of Aero ITI-trained men requested by one of the world's largest aircraft builders. These fellows saw the great future in Aviation . . . and trained at a school whose graduates are sought-for. In the last year alone, over 700 Aero ITI-trained men started their careers

in aircraft design, engineering, and production.

At Aero ITI you can train for aircraft production, aircraft maintenance, or aeronautical engineering. Five courses are offered—undoubtedly one of them meets your needs and circumstances. For complete information on Aero ITI training for an Aviation career, send the coupon NOW.

Aero Industries Technical Institute
5247 W. San Fernando Road, Los Angeles, Calif.

Aircraft Mechanics Offering U.S. Civil Aeronautics Authority Approved 12 Months **Aeronautical Engineering**

EXECUTIVE BOARD

ROBERT E. GROSS President, Lockheed Aircraft Corporation
JOHN K. NORTHROP President, Northrop Aircraft, Inc.
C. A. VAN DUSEN Vice-Pres., Consolidated Aircraft Corporation

Aero Industries Technical Institute

5247 W. San Fernando Road, Los Angeles, Calif.

Please send information on Aviation careers and Aero ITI training I am interested in the following branch of Aviation

☐ Aircraft Mechanics ☐ Aeronautical Engineering ☐ Undecided

Name..... Age.....

Address.....

City..... State..... a-26-s

INVENTORS

**Act Now TO PROTECT
YOUR INVENTION WITH U.S. PATENT**

Small Ideas May Have Large Commercial Possibilities

Inventions do not have to be complicated to be profitable when Patented. The 5c and 10c stores flourish on simple Patented products which are commercially successful. The zipper, safety pin, thumb tack, paper clip, collar button—all are simple yet familiar inventions—brought their inventors rich rewards. If you have a Patentable invention—act to protect it. Send for our FREE 48-Page Book that tells you how.



CLARENCE A. O'BRIEN

Dept. OB2, Adams Building, Washington, D. C.
Registered Patent Attorney before U. S. Patent Office

Free Book TELLS IMPORTANCE OF QUICK ACTION—HOW TO OBTAIN PATENT AND MARKET INVENTIONS

If you have invented something, if you're interested in inventing something, you need our new 48-page book that gives the entire Story of Patents. It tells you for the first time about new phases of invention, how others succeeded, how the patent laws protect you, how to market your invention, where to obtain finances, how to form a company, partnership, or arrange for royalties from your invention's sale.

PRACTICAL BENEFITS OF THIS BOOK

You will find 6 complete pages illustrated with simple inventions that have succeeded in six different fields of industry. Over 100 illustrations are in this book. You will read the stories of ten (illustrated) of America's most famous inventors. You will find an experienced and thorough survey of market conditions affecting the inventor—showing the possibilities for commercial invention today. Entire chapters are devoted to the value of a patent in promoting the final success of your invention. The importance of quick action in applying for patent is stressed—facts revealing danger of delay are emphasized.

If you expect to realize profits from your invention you must protect it with a U. S. Patent. Otherwise you may find that all your time and labor have been lost, because it often happens that other inventors are working on the same invention. If you have an invention, or an ambition to invent—get the information on obtaining patent AT ONCE!

FREE RECORD OF INVENTION FORM

When you send for our FREE BOOK, we include, also Free, our specially prepared Record of Invention blank, on which you can quickly make and date a sketch and description of your invention. This "disclosure" as it is called, may be absolutely invaluable as evidence for you, should your rights ever be contested. Be sure to get it and use it.

CLARENCE

REGISTERED PATENT ATTORNEY before U. S. Patent Office

For Quick Action

SEND TODAY



GET FREE 48-PAGE BOOK
and Free Form for Recording Your Invention

MAIL COUPON NOW
TO CLARENCE A. O'BRIEN
Registered Patent Attorney
BEFORE U. S. PATENT OFFICE

Clarence A. O'Brien, Dept. 0B2, Adams Building, Washington, D. C.
Please send me your Big. Free 48-Page Book for Inventors and your Specially Prepared Record of Invention form. This request does not obligate me.

Name.....
Address.....
City.....
(Please write or print plainly.) State.....

You Can Patent

**IMPROVEMENTS IN
MACHINERY, ARTICLES, DESIGNS, FORMULAS, ETC., IF NEW**

Every year thousands of Patents are granted. Very few, however, represent the discovery of entirely new principles. Most of them provide new methods of doing some every-day thing in a better way—changes for greater efficiency, usefulness, adaptability, or beauty in some previously Patented thing. These IMPROVEMENTS are patentable if new, and actually represent new inventions. These improvement Patents offer large chances for profit if commercially useful. The business world wants improved products and services.

FINISHED DRAWINGS NOT NECESSARY

Our Big Book tells you how you can start immediately to apply for Patent Protection even if you haven't finished models or drawings available now. It will tell you how we can prepare the specifications and finished drawings necessary in the form prescribed by the Patent Office—so as to secure for you full Patent Protection. Mail Coupon for Our Big Book TODAY.

OUR SERVICES TO YOU

We are registered Patent and Trade-Mark Attorneys, serving Inventors all over the United States and abroad. Our Organization is complete. We have Draftsmen, experienced Searchers and Attorneys to serve your interests. We can act as your legal adviser in all Patent

Matters. Our complete service is described in Our Big Book. Mail Coupon for it NOW.

REASONABLE FEES—CONVENIENT TERMS

Don't worry about finances. Our fees are very reasonable—we can arrange convenient terms of payment. It is our custom to permit clients to pay for our services in installments as the application progresses in our office. See our Big Book for fees in obtaining Patent. It explains our arrangements clearly. Send for it NOW.

GET FREE BOOK—MAIL COUPON NOW


If you have an invention in the making—if you simply have the crude elements of an invention in mind—you should have our Big FREE BOOK without delay. It will guide you every step of the way—from the preliminary search stage to the issuance of the final patent grant. This book contains twenty-five chapters describing in plain man-to-man language the story of obtaining a patent and marketing an invention. This book is absolutely FREE—just tear off the above coupon or write us a letter or postcard TODAY!

CLARENCE A. O'BRIEN
Dept. 0B2, Adams Building, Washington, D. C.
Registered Patent Attorney before U. S. Patent Office


A. O'BRIEN

Dept. 0B2, Adams Building WASHINGTON, D. C.

FOR MEN WHO WANT TO LEARN A PROFITABLE TRADE



Complete DIESEL TRAINING



NO MATTER WHERE YOU ARE OR WHAT YOU DO

—we have a training plan for YOU!

IF you are sincerely ambitious and interested in making good in the Diesel field, be sure to immediately investigate our flexible training plan that will fit your circumstances. A Plan for every Man. A Plan for those seeking immediate shop training as well as for those who cannot give up their present employment and income. For 34 years National Schools, a recognized leader in the field of trade education, has helped wide-awake men to success. This million-dollar trade school will supply you with a sincere, honest statement of facts of what you should do to quickly get into the profitable Diesel Industry. No exaggerations—no misstatements; and a definite plan to fit you.

Write Today For Full Details

Mail the coupon below. Find out how you can get the finest in Diesel training without delay. See how this great trade school operates and makes its facilities available to every ambitious man. Actual work in modern training shops, a part of every man's instruction. Shop methods time-tested for 34 years. Fascinating, efficient preparation. Get the facts.

WE ARE DEFINITELY INTERESTED IN HELPING MEN OF LIMITED INCOME AND "BLIND ALLEY" JOB HOLDERS.

NATIONAL SCHOOLS

LOS ANGELES, CALIF.

Complete Training in Diesels and Gas Engines

Oldest Trade School in West

Mail Coupon For FREE Literature

Request for Free Literature

NATIONAL SCHOOLS, (established 1905) Dept. PSA-2
4000 South Figueroa Street, Los Angeles
Please send me, without obligation, your FREE LITERATURE and information.

NAME _____ AGE _____

ADDRESS _____ CITY _____ STATE _____

ELECTRICAL ENGINEERING

★ ONE YEAR Residence Course

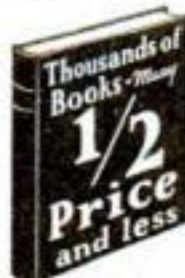
Condensed course trains you for technical positions in minimum time. Combines theory with practical work in well-equipped laboratories. High employment record is industry's endorsement of Bliss training. Thousands of successful graduates. Suburban campus; modern buildings; dormitory. 47th year. CATALOG. Give age.



BLISS ELECTRICAL SCHOOL

102 Takoma Ave., Washington, D. C.

ANY BOOK IN PRINT!



Delivered at your door. We pay postage. Standard authors, new books, popular editions, fiction, reference, medical, mechanical, children's books, etc.—all at guaranteed savings. Send card now for Clarkson's 1940 Catalog.

FREE Write for our great illustrated book catalog. A short course in literature. The buying guide of 300,000 book lovers. The selection of a metropolitan book store brought to your home. **FREE** if you write **NOW—TODAY!**

CLARKSON PUBLISHING COMPANY
Dept. PS 4-1255 So. Wabash Ave., Chicago, Illinois

Correspondence Courses in RADIO and ELECTRICAL ENGINEERING **LOW AS \$25**

ELECTRICAL ENGINEERING. Get good grasp of wide electrical field. Modern. Very understandable. Theory made easy.
RADIO ENGINEERING. Extra fine course in radio, public address, photo-electric work. Trains you to be super-service man, real vacuum tube technician. Tuition **ONLY \$25**, either course. Deferred payment plan. Experiment kits furnished. **FREE** Write for free copies of school catalogs, student magazines, etc.
LINCOLN ENGINEERING SCHOOL, Box 931-S-14, Lincoln, Nebr.

Learn to play...

Easy lessons at home. Inexpensive. 132-page Music Dictionary **FREE** when you enroll. Stop lessons when you like. Money back guarantee. Write for free details. **Hamann Institute, 3016 N. 24th Place, Dept. F11, Milwaukee, Wis.**

Hawaiian Steel Guitar
Spanish Guitar
Piano



Learn to Write

Begin Today. Write for our Free Book, "How to Become a Good Penman." It contains specimens and tells how others learned to write in spare time. Your name elegantly written on a card if you enclose stamp for postage. Write today. **The Tamblin School of Penmanship, 439 Ridge Bldg., Kansas City, Mo.**

IT'S EASY TO MAKE BIG SPARE TIME MONEY

Send for our free plan on how to make \$5.00 to \$15.00 a week in your spare time by taking orders for the **NEW POPULAR SCIENCE MONTHLY** from your friends. No selling required. Turn extra hours into extra dollars.

POPULAR SCIENCE MONTHLY

353 Fourth Ave. Dept. 20C New York, N. Y.

Do You Want To Sell or Patent Your Invention?

See **PATENT ATTORNEYS** : : : : Page 57
and **PATENTS FOR SALE** : : : : Page 57



NEW! Pocket Size Combination
Sending & receiving **RADIO**

The smallest tube radio in the world. **SIZE ONLY 3"x4 1/2"x1 1/2"** COMPLETE WITH SELF CONTAINED BATTERIES! Wt. only 15 Ozs. Fits easily in any pocket. Use it everywhere you go. Receives distant broadcast stations and will **BROADCAST** your voice and music to any ordinary radio hundreds of feet away! No changes or plug-ins! Two or more **"TINYDYNES"** make a complete **"WIRELESS PHONE"**—Truly a marvelous radio combination! Anyone can operate it in a minute! Sent complete with "Mike-Phone", instructions, etc. **PRACTICAL—SIMPLE—A REAL VALUE!** Beautifully finished in durable steel crackle case. **SEND ONLY \$1.00** (Check, M. O., Cash) and pay postman only \$3.99 plus postage. **GUARANTEED.** Order your **"TINYDYNE"** now and have the newest thing out! **MIDGET RADIO CO. Dept. TPS-2 Kearney, Nebr.**

1 Year Gov't Approved Course

DO YOU WANT A JOB IN AVIATION?

Luscombe School can train you to take advantage of the better paid positions in the Aircraft industry. Luscombe offers thorough training in modern Metal Aircraft production. A copy of "Opportunity in Aviation," and our school paper "The Luscombe Highlight," sent on request.

**PLACED
90%
OF OUR
GRADUATES**

LUSCOMBE

**SCHOOL OF AERONAUTICS
WEST TRENTON, N. J., Dept. P**



LAW STUDY AT HOME

Legally trained men win higher positions and bigger success in business and public life. Greater opportunities now than ever before. Big corporations are headed by men with legal training.

More Ability: More Prestige: More Money

We guide you step by step. You can train at home during spare time. Degree of LL. B. Successful graduates in every section of the U. S. We furnish all text material, including 14-volume Law Library. Low cost, easy terms. Get our valuable 48-page "Law Training for Leadership" and "Evidence" books FREE. Send for them NOW.

LaSalle Extension University, Dept. 283-L, Chicago
A Correspondence Institution



ART

MAGAZINE for Artist, Teacher, Student, Lover of the Body Beautiful. Contains splendid drawings, prints of Animals, Birds, Human Figure, ETC., also Lessons in Cartoon, Lettering, Design, Chalk-talk, Nature, Life, ETC. Can't be described! To INTRO-

DUCE we offer 5 BIG BACK ISSUES, 288 pgs., (50 page Rotogravures), also large Cartoon Book, also 8 other instructive booklets (14 in all) for ONLY \$1., prepaid. (34 Back Issues, and books, \$2.00 via Exp.) Student writes—"I'd buy mine if I couldn't replace." None free—You can't lose, OK or refund.

CUT THIS OUT Send with \$2 or \$1 NOW! Supply limited.
The Lockwood Art Studio, Department 41, Kalamazoo, Mich.

HOW TO PLAY THE HAWAIIAN WAY



HAWAIIAN GUITAR—Learn to play this EASY, SHORT CUT WAY, right in your own home. No tedious practicing. No special talent necessary. Have fun. Be popular. Surprise your friends. Get "on the air." Make money teaching others. Hundreds of our students now successful in orchestras, teaching, radio. You can do the same.

FREE ILLUSTRATED BOOKLET

"How to play the Hawaiian way" tells all about this quick, fascinating method. Write today.

**OAHU SCHOOL OF MUSIC, 2114 Payne Ave.
Cleveland, Ohio**

STUDY ENGINEERING AT HOME

Earn a Degree at Home

From A Chartered Institution of Higher Learning
Employers Demand Degree Men For Key Positions
88 Degree Courses in Electrical, Civil, Mechanical, Drafting, Architectural, Automotive, Steam, Diesel, Aeronautical, Radio, Structural, Mining, Industrial, Highway, Petroleum, Marine, Refrigeration, Air Conditioning, Chemical Engineering, Arts, Sciences, Philosophy, Education, Public Health, Psychology, Sociology, Physics, Chemistry, Geology, Pol. Science, Theology, Law, Agriculture, Business Training, Accounting, Statistics, Adv., Sales. Founded 1908. Chartered
McKinley-Roosevelt Graduate Colleges, 4750-B Sheridan Road, Chicago



LEARN CARTOONING!

Let a practical, experienced cartoonist teach you this fascinating profession. PERSONAL instruction, just like private tutoring. Recommended by America's foremost cartoonists. Write for free details.

Dorman H. Smith, Box 5970, San Rafael, California.

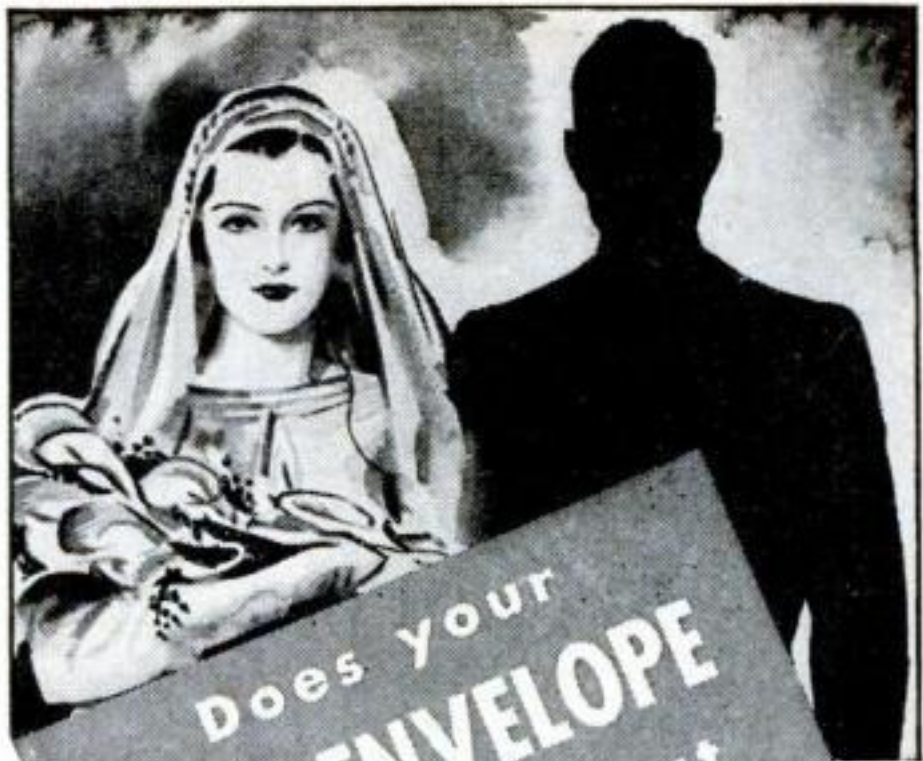
BARGAINS!!! Used Home-Study Courses BOUGHT-SOLD-RENTED

**72-PAGE
ILLUSTRATED
CATALOG
FREE**

Write today for big FREE illustrated catalog explaining this amazing service. Used correspondence courses and educational books on every subject. 100% satisfaction guaranteed. We buy for cash—we offer unbelievable bargains. Send your name on penny postcard at once! No obligation.

NELSON CO.

B-202 Manhattan Bldg. Chicago



Does your
PAY ENVELOPE
keep you out
of this picture?

● If it does, do something about it! Get a raise in salary—but first get the training that will entitle you to this raise. Thousands of men in the same fix as you have gotten this training by spare-time study of an I. C. S. Course. Mail the coupon today!

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 7678-J, SCRANTON, PENNA.

Explain fully about your course marked X:

TECHNICAL AND INDUSTRIAL COURSES

- | | | |
|-------------------------------------------------|---------------------------------------------------|--------------------------------------------------------|
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Air Brake | <input type="checkbox"/> Managing Men at Work |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Manufacture of Pulp and Paper |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Auto Engine Tune-up | <input type="checkbox"/> Marine Engines |
| <input type="checkbox"/> Auto Technician | <input type="checkbox"/> Aviation | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Navigation |
| <input type="checkbox"/> Building Estimating | <input type="checkbox"/> Chemistry | <input type="checkbox"/> Patternmaking |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Plumbing |
| <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Practical Telephony |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Poultry Farming |
| <input type="checkbox"/> Foundry Practice | <input type="checkbox"/> Fruit Growing | <input type="checkbox"/> Public Works Engineering |
| <input type="checkbox"/> Heating | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Radio Operating |
| <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Radio Servicing |
| <input type="checkbox"/> Machinist | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> R. R. Section Foreman |
| | | <input type="checkbox"/> R. R. Signaling |
| | | <input type="checkbox"/> Refrigeration |
| | | <input type="checkbox"/> Sheet Metal Work |
| | | <input type="checkbox"/> Steam Electric |
| | | <input type="checkbox"/> Steam Engines |
| | | <input type="checkbox"/> Structural Drafting |
| | | <input type="checkbox"/> Structural Engineering |
| | | <input type="checkbox"/> Surveying and Mapping |
| | | <input type="checkbox"/> Telegraph Engineering |
| | | <input type="checkbox"/> Textile Designing |
| | | <input type="checkbox"/> Welding, Electric and Gas |

BUSINESS COURSES

- | | | |
|--------------------------------------------------|----------------------------------------------|-----------------------------------------------------|
| <input type="checkbox"/> Advertising | <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Grade School |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Business Management | <input type="checkbox"/> High School |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Civil Service | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> College | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Lettering Show Cards |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Commercial | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Foremanship | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> French | | <input type="checkbox"/> Secretarial |
| | | <input type="checkbox"/> Service Station Salesman's |
| | | <input type="checkbox"/> Sign Lettering |
| | | <input type="checkbox"/> Spanish |

DOMESTIC SCIENCE COURSES

- | | |
|-----------------------------------------------|----------------------------------------------------------------------|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Professional Dressmaking and Designing |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Home Dressmaking | |

Name..... Age.....

Address.....

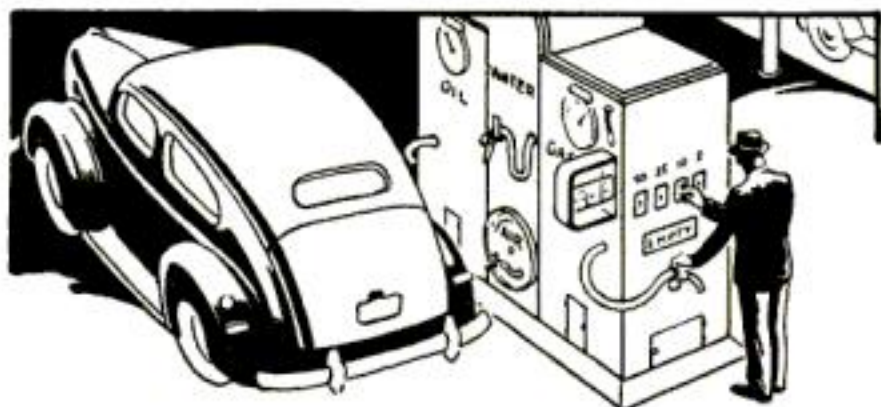
City..... State.....

Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

With the Inventors

GASOLINE, oil, air, water, and repair tools are all made available to motorists by an automatic, coin-operated service station invented by Peggy K. Masson, of Forest Hills, N.Y. When a motorist drives



up to the roadside unit and inserts coins in the slots provided, a supply of gasoline or oil is measured out according to the amount of money inserted. The car owner then places the connecting hose in his gas tank or oil-filler pipe, turns a lever, and the measured liquid flows out. Inserting any coin to purchase gas or oil automatically turns on the water and air supplies, which may then be used free of charge, and also unlocks a door to a compartment containing automobile and tire repair tools, each attached to a long chain . . . IN A STRAIGHT ASSIGNMENT of a patent, the purchaser of a one-percent interest has as much right to use and exploit the invention as the owner of the remaining ninety-nine percent . . . WHEN A CYCLIST



PEDALS along a level or down grade on a bicycle equipped with a novel hydraulic-drive attachment, he builds up a surplus store of energy in the device which can later be released to furnish additional power for increasing speed or mounting a hill. In operation, the pedal action not only drives the bicycle's rear wheel, but also operates a pump in the unit to force a

fluid into a storage chamber and compress a series of springs. The stored energy in the springs can then be released whenever the rider desires, to help drive the wheel. This is the invention of Conrad Bichi, of

San Francisco, Calif. . . CONE-SHAPE PROJECTIONS OF RUBBER form the surface of an unusual snowless ski slide developed by Hugh F. Bethell, of Norwalk, Conn. Said to provide a surface on which skiers can execute the same maneuvers they employ on real snow, the rubber cones are molded in one piece with rubber-block bases, which are mounted on an inclined wooden or metal slide. As the skis move down across them, the flexible cones bend down, springing back into place after the ski has passed by. Water fed into a trough behind the rubber



blocks, squirts through tiny holes to lubricate the cones whenever a weighted ski passes over . . . ONLY IF PATENT OFFICIALS are convinced that the result will be an immediate investment of money and consequent employment of labor, will they consent to examine a patent application out of its regular turn . . . A MAZE OF DRAWERS, compartments, dispensing units, holders, and grooves are built into a curious folding-leg game table invented by John G. Blaschke, of Hot Springs National Park, Ark. Sliding out of openings in three sides of the table top are half-moon holders for chips, dice, and other game accessories. A drawer is provided on the fourth side for game boards, pencils, paper, and other incidentals. Beneath ash trays at the four corners are



storage compartments for cigarettes which are automatically delivered one at a time when a sliding panel is pulled outward. The upper end of each table leg is hollowed out to accommodate a glass, which can be rest-

(Continued on page 24)

THESE FREE BOOKS ARE FOR INVENTORS

AND OTHER MEN WITH IDEAS

"We're only entering the great period of inventive advancement"

—says C. F. Kettering, Vice Pres., General Motors.

SOMETIMES we hear people say: "Well, there isn't much left to invent." But Charles F. Kettering, Vice-Pres. and Head of Research of General Motors, who helped develop the self-starter, Duco and many other outstanding inventions, **doesn't think that at all.** In a published statement, he said:

"If we took half the men employed in tool making and put them to working out new inventions, new things, we could snap out of this depression in no time. Our return to normal times depends on new manufactured products that will catch the purchaser's eye, get him to buy and thus start the ball rolling. Change and buying go together. *We are only entering the great period of inventive advancement.*"

Many Little Ideas Have Big Commercial Possibilities

Some of the world's best inventions came from men who didn't consider themselves inventors at all. The telegraph was invented by a painter, the typewriter by a farmer, the hand camera by a bank-clerk, the stock ticker by a dentist. Or look at small inventions. A husband noticed his wife bending a hair pin to make it stay put. That gave him the idea of the crinkly hair pin. One day a golfer got the idea to make a wooden tee. Now wooden tees are sold by the millions every year. There are many similar examples in inventive history. That is why we say that the books shown here are for INVENTORS and Other Men with IDEAS. Whether you consider yourself an inventor or not—if you have an idea that will make money, save time, save labor, or give pleasure—find out how you can protect your rights to it.

Our Business Is to Help You

For forty-two years, this organization has been in the business of helping inventors. During that time inventions from every corner of the country have been turned over to us to protect. Some ideas have represented complicated mechanisms; others have been small, practical articles, like a can opener or a new toy. All this has given us a wealth of experience to use for the inventor of today. Here in Washington, we maintain a large staff of experienced Patent Specialists to give you prompt and expert service. Yet because we work efficiently—our fees are low, and if desired we help you with deferred payments. But first, find out exactly what to do to protect yourself. **Decide on that today by sending for your FREE copies of the books shown above.**

Suggestions on
WHEN
and
HOW
to Sell an
INVENTION

THESE BOOKS TELL YOU:

How the Patent Laws protect an inventor. Simple steps to take promptly, without cost, to claim your right to your idea. Kind of sketch or model needed. How you can go about selling an invention. They are full of valuable facts, simple, easily understood suggestions and interesting bits of inventive history. We gladly send them to serious men. No charge, no obligation. Write us or use the coupon below. **Get that much done today.**

PATENT PROTECTION

VICTOR J.
EVANS & Co.

Registered Patent & Trademark Attorneys

Main Office: 570-B VICTOR BUILDING, Washington, D. C.
Pittsburgh Office: 514-C Empire Building

Rush by return mail **FREE** copies of your books, "Patent Protection" and "When and How to Sell an Invention", also important **EVIDENCE OF INVENTION FORM**. I want to know if I can quickly and safely commercialize my invention.

Name

Address

City or Town

**THIS COMPLETE, SIMPLE, PRACTICAL COURSE
FOR SELF-INSTRUCTION WILL QUICKLY GIVE YOU**

A Complete Mastery of MATHEMATICS



**A Complete
Course and
Reference
Library in
5 Volumes**

**Arithmetic
Algebra
Geometry
Trigonometry
Calculus**

1598 Pages Illustrated

He presents each practical method and problem in the clearest, simplest way. He gets right down to the kind of information that you need in your daily work.

**Send No Money—Mail This Coupon
for FREE EXAMINATION**

D. Van Nostrand Co., Inc., 250 Fourth Ave., New York
Send me MATHEMATICS FOR SELF-STUDY in 5 volumes.
Within 10 days I will either return the books or send you \$2.95
as first payment and \$2.00 per month for 3 months—total \$8.95
(5% discount for cash). (P.S.M. 2-40)

Name

Address

City and State.....

Reference.....

Address

☐ FOR FREE CATALOG of best books of practical instruction and technical information, check here. If you do not want Mathematics for Self-Study, cross out paragraph above.

Prepare now to advance yourself to an important job by *Mathematics Training*. *Mathematics* is the foundation of all mechanical and scientific work, and of all business or industry based on science. Without this essential knowledge even the most capable man is left behind while others forge ahead to better jobs, bigger contracts, more money. You need mathematics to solve technical problems and to improve, speed up and check on your work and the work of others.

Now you can learn mathematics by an easy, inexpensive and time-saving method. A very simple and extremely interesting course in book form has been prepared for you by an expert who has devoted a lifetime to teaching practical men the fundamentals of this important subject.

MATHEMATICS FOR SELF-STUDY

By J. E. Thompson, B. S., A. M.,
Dept. of Mathematics,
Pratt Institute

These books start right from the beginning with a review of arithmetic that gives you special short-cuts and trick methods that save countless hours of your time. Then they go right into higher mathematics and show you how simple it is when an expert explains it for you. In no time at all you will be tackling with ease the most difficult questions on this subject.

An Expert's Simplified Methods

Mr. Thompson, the author of these books, has had many years' experience in mathematical training.

With the Inventors

(Continued from page 22)

ed on the hinged cover of the compartment when opened to a horizontal position . . . PATENT LAWS ARE BASED ON Article 1, Section 8, of the Constitution of the United States: "The Congress shall have Power To



promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." . . . "ROWING" A SLED ACROSS LEVEL SNOW is possible with a novel propelling mechanism worked out by Walter Eberhardt, of Chicago, Ill. Sitting on the sled, feet forward, the rider grasps two vertical levers pivoted at the sides of the sled, and works them back and forth. This causes pointed arms to dig into the snow and push the sled forward . . . A HANDY PLACE FOR STORING various sick-room necessities is provided by an electrically operated drawer designed by Blanche Hudon, of New York City, so that it can be installed under a hospital bed. Driven by a small electric motor and rolling



on parallel tracks, the storage drawer slides out sideways when the patient touches a button at the head of the bed. The patient can then reach the contents of the opened drawer with no movement other than reaching his hand out over the side of the bed . . . A PROMINENT AUTHORITY STATES that the majority of the inventions that ultimately

prove most valuable and return the greatest financial rewards are those which have been sold or assigned before the patent has actually been granted . . . TO ENABLE DENTISTS TO SHOW their patients how a new set of
(Continued on page 26)

GET IN THE SWING with Slingerland RADIO KING DRUMS GUITARS



GENE KRUPA—World's Greatest Swing Drummer uses Slingerland

bugles—before you buy. Guaranteed more for your money. Acclaimed the tops in smooth tone, easy playing, rich power by world's leading musicians. Easy payments. 5-days free trial. See at your dealers.

Cut this ad out—good for \$1.00 credit. Free special information on how to organize drum and bugle corps. Free catalog—mention instrument wanted.

SLINGERLAND DRUM CO.
1319 Belden Avenue Chicago, Illinois

Wonder Value Easy Payments

Compare the value—tone and power in Slingerland "Radio King" drums, banjos, guitars, mandolins, marimbas, or



Inventors Free Books



Answer your questions!

Practical Facts You Will Want to Know About

PATENTS

TRADE MARKS
COPYRIGHTS

Get Facts First—Save Time and Money

Now one of America's oldest firms of patent attorneys offers you important facts on how to protect and commercialize your ideas . . . the very facts which can save you wasted hours and unnecessary expense. These free books are based on 64 years' experience and tell you exactly what to do to protect your invention.

Find Out RIGHT NOW

Before going any further with your idea—be sure you are on the "right track". You will be able to know before spending more time and money the costs and procedure in obtaining a patent. In the books you will find the plain answers to questions that have long bothered inventors.

Confidential, quick service

All inquiries are answered immediately and held in strictest confidence. Write today.



MAIL NOW FOR
FREEBOOKS

C.A. SNOW & CO.
Registered Patent Attorneys Since 1875

Dept. 202, SNOW BUILDING, WASHINGTON, D. C.

Gentlemen: Please send me absolutely free and without obligation on my part, your original document "Certification of Invention" together with your two books for Inventors, "How We Protect You" and "Suggestions On How to Commercialize Your Invention."

Name

Street and No.

City or Town State

PATENTS PERSONAL SERVICE

My Personal service assures strictest confidence on all your patent problems. Send me a model or drawing, or

sketch and description of your invention, and \$5.00. I will make a search and report promptly as to its patentability and send you a copy of my 72-page booklet. Or, if you prefer to read my booklet first, write today for FREE copy. Registered Patent Attorney.

L. F. Randolph, 340-D Victor Bldg., Washington, D.C.

Please mention POPULAR SCIENCE when writing to advertisers.

Inventions Promoted

Patented or Unpatented. In business over 30 years. Send drawing and description or model, or write for information. Complete facilities. References.

ADAM FISHER COMPANY

183-D Enright, St. Louis, Mo.

New Ideas now Salable Before Patenting

Practical, useful inventions may now be safely marketed without patenting expense. Write for proof that we have been successfully selling both patented and unpatented inventions, since 1924.

Chartered Institute of American Inventors
Dept. 3, Barrister Building Washington, D. C.

YOU CAN GET IN AVIATION

The highest possible endorsement of SPARTAN TRAINING is the approval by the Army Air Corps to use Spartan facilities for instruction of BOTH Flying and Mechanical Students. YOU—get the same training that has been approved by the Army and Civil Aeronautics Authority. Government Approved Courses that have qualified hundreds of successful graduates for positions now open. Write for illustrated catalog and full information.

SPARTAN SCHOOL OF AVIATION
HOME OF THE DAWN PATROL
Dept. PS-6, Capt. Maxwell W. Balfour, Director, Tulsa, Oklahoma

TRI-STATE COLLEGE B-S-Degree in 2 years

World famous for technical 2-year courses in Civil, Electrical, Mechanical, Chemical, Radio, Aeronautical Engineering, Business Administration and Accounting. Special preparatory department for those who lack required high school work. Short diploma courses (36 weeks) in Surveying, Drafting. Low tuition. Low living costs. Students from every state and many foreign countries. 57th year. Enter March, June, September, January. Write for catalog. **Burton Handy, Pres., 520 College Ave., ANGOLA, INDIANA.**

MONEY for MEN ALL FREE

THE PLASTEX Industry needs manufacturers on small scale and for big production of Lamp and Clock Stands, Art Goods and Novelties in Plastex and Marble Imitation. Experience unnecessary. 1/2c material makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings big returns. "Goods BOUGHT and SOLD in large quantities." Ambitious men have chance for real prosperity. Our Free booklet will interest and benefit you.

PLASTEX INDUSTRIES, Dept. 2, 1085 Washington Ave., New York, N.Y.



DRAFTING

BOOKS SENT FREE!

**ON APPROVAL
5 VOLUMES BRAND NEW EDITION**

Only 15 minutes a day with these WONDER BOOKS can prepare you for a good drafting job in less than a year. Mechanical and architectural drafting from simple straight lines to important complex plans. A step at a time. Built especially for beginners, for men with only grammar schooling. Drafting room practice, PLUS ENGINEERING, made easy and clear. Includes complete information on blue print reading for building and machine trades.

Big Field Big Demand Big Pay

Competent draftsmen are urgently needed right now in all building and manufacturing lines at \$30.00 to \$75.00 a week. That's just the beginning—FOR DRAFTSMEN HAVE GOOD CHANCES FOR ADVANCEMENT. Pleasant, fascinating work, easy to learn and do. Learn quickly with these books—send coupon for a set and see for yourself.

A year's consulting membership in the American Technical Society now given to all owners of this famous cyclopedia of drafting.

Complete set of high grade drawing instruments if you send for these drafting books NOW. These instruments are absolutely accurate and are packed in velvet lined leatherette pocket case. Splendid value, but included with these books.

**AMERICAN TECHNICAL SOCIETY
Dept. D220, Drexel at 58th St., Chicago, Ill.**

For Beginners or Experts

Written so you can understand every word, by 22 well known engineers and architects. DeLuxe flexible binding, nearly 2,000 pages, 1546 blueprints, charts and diagrams; prepares you for a good drafting job in mechanical or architectural lines. Sent for 10 days' free use if you mail coupon immediately.

These Instruments Included



American Technical Society, Dept. D220, Drexel at 58th St., Chicago, Ill. Send for 10 days' trial, new 5 volume set of drafting. I will pay the few cents delivery charges. If I wish, I may return books in 10 days and owe you nothing but if I decide to keep them, I will send \$2.00 after 10 days, then only \$3.00 a month until \$24.80, the total price is paid. Send latest edition and include drawing instruments and consulting Membership Certificate.

Name.....
Address.....
Please attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference.

PATENTS—TRADE MARKS

All cases submitted given personal attention. Form "Evidence of Conception" with instructions for use and "Schedule of Government and Attorneys' Fees"—FREE!

LANCASTER, ALLWINE & ROMMEL
(Patent Law Offices)

413 Bowen Bldg. Washington, D. C.

INVENTORS PATENT YOUR IDEAS SEND FOR FREE BOOK

HOW TO OBTAIN A PATENT

Written by a Former Member of the Examining Corps (1922-24) of the U. S. Patent Office. If you want to profit by your idea, you should take steps to apply for a U. S. Patent at once. Your first step is to get this Free Book. This interesting illustrated book contains valuable information you should have. It tells you fully how to obtain a patent on your idea in the quickest way. With this Free Book you will also receive a "Record of Invention" form on which you can easily record your idea. Personal and Confidential Service: Your case will be personally handled only by a Registered Patent Attorney who is also a Former Member of the Examining Corps of the U. S. Patent Office. All communications confidential.

MAIL COUPON TODAY for FREE PATENT BOOK and RECORD OF INVENTION Form.



CARL MILLER

**REGISTERED PATENT ATTORNEY
FORMER MEMBER EXAMINING CORPS U. S. PATENT OFFICE**

Woolworth Bldg., 35th Floor, Dept. 20-C, New York City
MILLER BUILDING, Dept. 20-C, WASHINGTON, D. C.

Please send me your Free Book, "How to Obtain a Patent," and your "Record of Invention" form.

NAME.....
ADDRESS.....

With the Inventors

(Continued from page 24)

false teeth will look, George H. Burtenshaw, a New Zealand inventor, has developed a novel apparatus employing facial masks, each having a different expression. Four of these mounted on a metal framework revolve around another rotating wheel that supports sets of false teeth in different styles and sizes. By manually turning the inner wheel and the masks, the dentist can make any set of teeth appear in the mouth opening of any mask . . . DEVISING NEW AND BETTER METHODS of filing the millions of patents in the U.S. Patent Office is the exclusive work of a special staff maintained by patent officials . . .



WINTER WINDS WON'T WHISTLE IN under the foot of bedclothes held in place by a bed attachment invented by Herman B. James, of Los Angeles, Calif. Sheets and blankets are attached by clips to a horizontal bar stretched across the foot of the bed. By means of a spring-operated mechanism, controlled by a lever at the head of the bed, the covers may be raised slightly over the feet of a sleeper to prevent discomfort from their weight or tautness . . . WHAT IS THE DIFFERENCE between a patent, a copyright, and a trade mark? When a patent is granted, protection is secured on an invention, whereas a copyright secures protection on a work of literature or of the fine arts. The patent and the copyright both involve orig-



inality. On the other hand, the selection of a trade mark to protect the name or symbol of an item of merchandise need not be guided by originality, provided no one else has applied it to the same kind of merchandise.

How to Perform PROFESSIONAL



MAGIC
for Fun
and
Profit

SEND for the big new 345-page MODERN MAGIC MANUAL and let a famous magician show you how to mystify friends and audiences with hundreds of amazing tricks known only to the profession. Read minds and sealed letters; make cigarettes appear and vanish; make watches fly; make knots untie themselves; pass a dollar bill into an uncut lemon—hundreds of startling effects, many brand new, closely-guarded secrets of master magicians are explained in detail with step-by-step instruction on how to do each trick and become a successful performer.

250 Illustrations Show You How

Easy-to-follow drawings by Nelson Hahne, himself a noted magician, show exactly how to produce the effects so mystifying to beholders. And the hundreds of tricks set forth require only simple apparatus—or none at all. Many of the most startling are the easiest to do—when you know how.

**Examine
It 5 Days
FREE!**

Take advantage of this unique opportunity to master professional magic now. Tear out this ad. Write your name and address in the margin. Mail to Dept. P, Harper & Brothers, 49 E. 33rd St., New York. A copy of Hugard's Modern Magic Manual will be sent to you at once. After 5 days return it or remit only \$3.50.

New York Electrical School

Established
1902

Ask for free
illustrated booklet

40 West 17th St., N. Y. C.

**There's
MONEY
IN ARC
WELDING!**



U. S. Manufacturers

desire men to learn Electric Arc Welding and get practical experience under actual production conditions in the laboratories of the School of Engineering. Moderate training fee. Accepted applicants will be fully trained until ready to pass rigid test and assisted in securing employment.

AIRCRAFT WELDING

"We want more planes!" That's the demand on every side. No wonder there is a shortage of aircraft welders. Other industries need welders, too. There's almost no limit to what Milwaukee School of Engineering trained welders can do. They get good pay because they know the "how and why" of Welding, Metallurgy, Drawing, Blueprint Reading, Set-up Work and Fabrication—and they enable manufacturers to cut production costs. Remember—industries need practical trained Aircraft Welders, Arc Welding Operators, Technicians and Welding Engineers, and Air Conditioning and Refrigeration Technicians. Don't be satisfied to struggle along on ordinary, hit-or-miss jobs with poor pay—when in a short time you can become a trained specialist. Send coupon today—classes begin within a month.

MILWAUKEE SCHOOL of ENGINEERING

Institute of Electrotechnics

PS-240A North Broadway and E. State, Milwaukee, Wis.

Without obligation send Free Booklet "The Dawn of a Gigantic Industry and its Outstanding Opportunity." Also tell me How to Become an
Arc Welding Operator (3 mo.)... Air Conditioning & Refrig. Tech. (4 mo.)...
Air Craft Welder (6 wks.)... Radio Serviceman (6 mo.)...
Welding Technician (5 mo.)... Commercial Electrical Engineer (1 yr.)...
Welding Engineer (1 yr.)... Commercial Radio Engineer (1 yr.)...
Electrical Engineer... Student Loan Plan...
B. S. Degree (4 yrs.)... Earn Part Expense Plan...

Name..... Age.....
Address..... City..... State..... PS-240A

Our Graduates Run



47%

of ALL the
Identification Bureaus
in America

Send for complete list of over 600 Bureaus where our graduates have been placed in good positions as

FINGER PRINT EXPERTS

Then write the nearest Bureau and learn what our graduates think of us!



We have space here to list only a FEW of these more than 600 institutions, so be sure to send for the complete list!

State of Utah	Schenectady, N. Y.
State of Ohio	Scranton, Pa.
Boston, Mass.	Lincoln, Neb.
New York, N. Y.	Mobile, Ala.
Pittsburgh, Pa.	Little Rock, Ark.
St. Paul, Minn.	Pontiac, Mich.
Mexico City, Mex.	Havana, Cuba
Augusta, Ga.	Miami, Fla.
Seattle, Wash.	Birmingham, Ala.
Omaha, Neb.	Columbus, Ohio
Des Moines, Ia.	Galveston, Tex.
Montreal, Can.	Houston, Tex.
Cedar Rapids, Iowa	Windsor, Ont.
Elgin, Ill.	Pueblo, Colo.
Syracuse, N. Y.	Salt Lake City, Utah
Tampa, Fla.	Atlantic City, N. J.
Long Beach, Cal.	Sioux City, Iowa
St. Louis, Mo.	Rochester, N. Y.
Lansing, Mich.	Cleveland, Ohio
Burlington, Ia.	Spokane, Wash.
Erie, Pa.	Fort Worth, Tex.
Oklahoma City, Okla.	Shreveport, La.
Trenton, N. J.	Waltham, Mass.
Detroit, Mich.	Berkeley, Calif.
El Paso, Tex.	Paterson, N. J.

Want a Regular Monthly Salary?

Be a Secret Service and Identification Expert!

Enjoy the thrill of getting your man—with no personal danger—PLUS a regular monthly paid salary and the opportunity to share in Rewards. Learn at home, in spare time, and at low cost, the unique secrets of this young, fascinating and fast growing profession. You have exactly the same opportunity that was offered the hundreds of our graduates who now hold splendid positions in more than 600 institutions. Each of these bureaus has anywhere from ONE to FIFTEEN of our graduates on regular salaries—and new openings develop from time to time.

Wonderful Opportunity for TRAINED MEN In This Young, Fast Growing Profession.

Of the thousands of towns in America, three-fourths are still without identification bureaus. Many more are bound to come! That spells OPPORTUNITY. But you must be READY. It's easy to master this profession that combines thrills with personal safety, AND the security of a steady income. We show you HOW—just as we have already shown the hundreds who now hold good pay positions.

FREE! The Confidential Reports Operator No. 38 Made to His Chief.

Just rush coupon! Follow this Operator's exciting hunt for a murderous gang. Also, get free, "The Blue Book of Crime," showing the wonderful opportunities in the field of Finger Prints and Crime Detection. Take your first step TODAY toward a steady income and success. Mail coupon NOW!

INSTITUTE OF APPLIED SCIENCE
1920 Sunnyside Ave., Dept. 1362, Chicago

INSTITUTE OF APPLIED SCIENCE
1920 Sunnyside Ave., Dept. 1362, Chicago.

Gentlemen: With no obligation on my part, send me Confidential Reports of Operator No. 38, also illustrated "Blue Book of Crime," complete list of bureaus employing your graduates, together with your low prices and Easy Terms offer. (Literature will be sent ONLY to persons stating their age.)

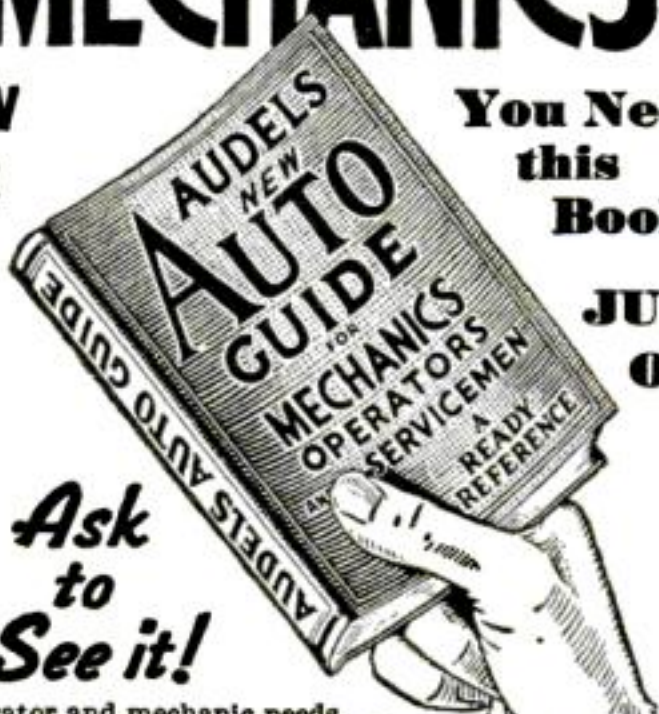
Name.....
Address.....
Age.....

MECHANICS

**KNOW
YOUR
CAR**

**You Need
this
Book
JUST
OUT!**

**Ask
to
See it!**



Every operator and mechanic needs AUDELS NEW AUTO GUIDE. This book saves time, money and worry. Highly endorsed. It presents the whole subject of auto mechanics: 1—Basic principles, 2—Construction, 3—Operation, 4—Service, 5—Repair. Easily understood. Over 1500 pages—1540 illustrations showing inside views of modern cars, trucks and buses with instructions for all service jobs. Diesel Engines fully treated, \$4 fully illustrated. To Get This Assistance for Yourself Simply Fill In and Mail Coupon Today.

4 COMPLETE • PAY ONLY \$1. A MONTH

THEO. AUDEL & CO., 49 WEST 23rd STREET, NEW YORK
Please send me postpaid AUDELS NEW AUTOMOBILE GUIDE (\$4) for free examination. If I decide to keep it, I will send you \$1 within 7 days; then remit \$1 monthly until purchase price of \$4 is paid. Otherwise, I will return it to you promptly.

Name

Address

Occupation

Reference P. S. M.

Complete RADIO COURSE \$1.95
Amazing Price Reduction
A limited quantity of the regular \$39.00 R.T.I. radio courses in reprinted form are offered to you at only \$1.95. These are the latest Radio and Television Courses, complete in every way, and exactly the same as the much higher priced original text. Rush your order today to obtain this remarkable bargain in radio training.



PREPARED FOR HOME-STUDY

Radio Technical Institute Course will give you all the training needed to get ahead in the growing fields of Radio and Television. No special education or previous experience is needed. The streamlined lessons are clear, interesting, easy to master and use. Fellows just like you have found this course the stepping stone to better jobs and higher pay. A final examination may be taken later and handsome diploma obtained. The special \$1.95 price for the complete course can be earned in an hour of radio work.

EVERYTHING ABOUT RADIO

The R.T.I. training is complete. Everything from simple facts to complex servicing problems. You really get three courses in one: (1) Elements of Electricity and Radio, (2) Practical and Applied Radio, and (3) Advanced Training. From the very start you are introduced to real servicing methods and equipment. The course is so planned that you will be able to earn nice spare time money before you reach the fifteenth lesson. This is your chance to obtain one of the BEST RADIO COURSES for \$1.95.

Guarantee

You must be pleased or your money will be immediately refunded. References: Any magazine publisher, or Dun & Bradstreet.

NEW LIMITED EDITION

There is but a small quantity of the courses left at the special reduced price. You can't go wrong with our "money back" guarantee. Send \$1.95 as complete payment for the entire course. Or we will ship C.O.D. charging a few cents postage. Answer today.

SUPREME PUBLICATIONS 3727 West 13th St. Room 302, Chicago, Ill.

NEW OIL BURNER SENSATION

**COOK
HEAT with
CHEAP
OIL**

SLIPS INTO ANY STOVE, RANGE or FURNACE. One of the latest oil burner patents—will not clog up—no cups or wicks—different. Even heat, much or little by turn of valve—better cooking, baking, heating.

**at
Amazing
LOW
PRICE**

30 DAYS' TRIAL Write today for try it before deciding offer—enjoy quick, regulated heat—see how it ends drudgery of coal and ashes.

**QUICK HEAT at
TURN of VALVE**

SAMPLE BURNER FOR AGENTS Write quick for SAMPLE OFFER that brings you one for demonstration. A money maker—big season now. Act quick—send no money, just your name, address.

ATLAS BURNER CO., B-295 Rockhill Theatre Bldg., Kansas City, Mo.



NOW ONLY

\$4.95

REAL ENGINE VALUE

Over 7,000 GHQ Gas Engine Kits were sold at \$8.50. Over 15,000 sold last year. Now is your chance to buy the New Improved kit for \$4.95. Absolutely complete with coil, plug, etc. 1/5 H.P. All parts guaranteed. For boats, planes etc. Send only \$1. Shipped Exp. Coll. for balance same day. Send 3¢ for new 16 page illustrated catalog. Dealers write.

All parts finished. ONLY A SCREWDRIVER NEEDED.

Average assembly time 30 minutes. DEALERS WRITE.

GHQ MOTORS, 40S East 21 St., New York, N. Y.

604 p. CATALOG, 7000 NOVELTIES

Rush 3¢ for mammoth catalog of unusual novelties. 604 pages, 4000 illustrations, 7000 novelties. Rotogravure section, 6-color cover. Radios, candid cameras, optical goods, novelty jewelry, unusual books & seeds, airplane & hobby kits, live animals, rifles & guns, fireworks, make-up supplies, joke goods, magic, outdoor & sport items, labor-saving devices, musical instruments, puzzles, wigs, auto & bike accessories, live ants, watches, knives, rubber stamps, smoker's novelties, European novelties, articles from the Orient and Far East, occult and fortune telling articles, money making outfits, muscle developers, religious articles, symbol jewelry, archery, fencing, stamps for collectors, projectors & films, etc., etc. (DELUXE CLOTH-BOUND EDITION, 15c)

JOHNSON SMITH & CO., Dept. 511-M, Detroit, Mich.



**Do more
Earn more
Work less
with a**

**Red Universal
Tractor**

You plow, disc, cultivate, mow, haul, do belt work, for about 33¢ a day. Safe, trouble-free long life. New plow lift, new reverse. Hundreds used. Save by buying from maker. Two weeks trial. FREE catalog. Write today.

PIONEER MFG. CO.

Dept. R-20 West Allis, Wis.

TELEGRAPHY

taught thoroughly. Renewed opportunities due to Railroad Retirement Act and increased business; some railroads experiencing shortage of efficient operators now. EVERY BRANCH OF RADIO ALSO TAUGHT. School established 1874. All expenses low. Catalog free.

DODGE'S INSTITUTE

Hall St., Valparaiso, Ind.



LEARN CHEMISTRY AT HOME

Complete 40 lesson HOME STUDY CHEMISTRY COURSE, by recognized authorities, (slightly soiled). ONLY \$10.00; former price \$145.00. Limited number of COMPLETE COURSES available at the low price of \$10.00. Remit, cash, stamps, check or money order. Full money-back guarantee. FREE literature on request.

Chemistry Division, A-126 E. 23rd St., New York, U. S. A.

ARE YOU "UNHANDY"?

At last a service and repair manual has been made for the auto owner who is not a mechanic. Here are hundreds of "horse-sense" methods for keeping your own car in perfect shape—no matter how old or how new it is. AUTO KINKS tells in non-technical language, made clearer by drawings and simple diagrams, what to do no matter what goes wrong—how to make temporary or permanent repairs to the motor, carburetor, ignition, lights, starter, radiator, chassis, running gear, body, fenders, top, and even the garage. Will give you more understanding of the mysterious "insides" of a car than anything you ever saw. Service men will get a world of new ideas from it too. 192 pages, full strong cloth binding, pictures on every page. Only \$1.00. Sent C. O. D. plus few cents postage. Ask for "AUTO KINKS." Write to

Popular Science Monthly, Dept 20C 353-4th Ave. New York, N. Y.



BUILD YOURSELF A MIDGET CAR

WE SPECIALIZE IN WHEEL SETS, ENGINES, ETC. for building Cars, Scooters, Trucks, etc. We carry only the best at the lowest prices. Send 10¢ for parts catalog and plans for three Midget Racers, Scooters & other vehicles. It pays to use only reliable plans and parts—We guarantee satisfaction. Build-Your-Own-Devices, 536 North Parkside, Dept. P. S., Chicago

Save Money. Use our Proved Plans and Parts

John made \$42⁵⁰ in one day in his NEW Business



● **Get into this Business Now—** a business which is so new that it is practically without competition. This should enable you to make really BIG MONEY. Hotels, homes, clubs, office buildings offer tremendous possibilities. Our new DETERGER washes upholstered furniture, electrically right in your customer's home, with a new soapless soap whipped into DRY suds. *No liquid touches the fabric*, therefore the furniture is ready for use soon after cleaning. We have helped hundreds of men get into business for themselves with our automatic equipment. The U. S. Government and many of the world's largest hotels use our machines.

Make Money the FIRST DAY

The Deterger is ready to use when you receive it, so you ought to be taking in big profits the first day. We want an honest, ambitious man in every locality. If you are that man we will help you get started for yourself in a business with tremendous possibilities.

No Rent to Pay You don't have to rent a shop. You don't have to hire a building, for you do the work right in your customer's home. You save the expense of carting furniture back and forth to a central plant; the owner's home is your workshop.

J. S. Corson says

"I cleaned seven living room sets and fourteen chairs, as well as twenty-five automobile interiors the very first month and made \$279.50." Berger Hanson wrote "My investment in your DETERGER was the wisest I have ever made. It is my most valued asset." Barrett says: "Made \$28.00 in eight hours, on another job made \$11.00 in two and one-half hours." Alex Gulkin's business expanded so fast that he already has SIX DETERGERS making money for him.



Pay as you Earn

Only a limited amount of money is needed for a down payment. The balance you send on easy terms. Most men find it possible to make far more than the cost of the machine before the payments come due. Every machine is fully **GUARANTEED** and satisfied customers send their friends to you.

No liquid touches the fabric when cleaning with the DETERGER.

Book sent FREE

Write today for copy of our booklet "Your Own Business. Profits Instead of Wages." Let us tell you how easy it is to get started in a year around business where you are your own Boss and can stop worrying about just a job. Write today—NOW.

VON SCHRADER MFG. CO., 612 Pl., Racine, Wis.

VON SCHRADER MFG. CO., 612 Pl., Racine, Wis.

Send me (without obligation) your free booklet telling me how I can own my own business and become financially independent and how I can pay for the DETERGER on easy terms.

Name _____

Address _____

City _____ State _____

8 TUBE 2 BAND SUPER AC-DC



each in lots of six or \$12.48 when purchased singly. Regular \$24.95 list model 3T3 GOLDENTONE. Check these 1940 features: Dynamic speaker. Walnut cabinet. Illuminated vernier aeroplane dial. "Goldenscope"—no aerial or ground required. Receives Coast to Coast on Broadcast and Police, Amateur, Aeroplane, etc., on Short Waves. One year guarantee. Send \$1.00 deposit, balance C.O.D. Money back if not satisfied.

GOLDENTONE RADIO CO. DEPT. PS DEARBORN, MICH.

RADIOS..SAVE UP TO 50%



DEAL DIRECT—FACTORY PRICES! Many models to choose from at wholesale prices. AC-DC midsets \$4.98. Portable and battery sets \$8.98 up. Car sets \$11.75 up. Also consoles, all-wave etc. Samples at 50% off. Send for FREE 1940 bargain catalog giving details of 10 day FREE trial and agent's proposition and discounts. No obligation, write today.

GOLDENTONE RADIO CO. DEPT. PS. DEARBORN, MICHIGAN

Would You Like a Choice Pet For a Pal?

See DOGS, BIRDS, PETS Page 54

BUILD YOUR OWN AIR CONDITIONING



COOL IN SUMMER—WARM IN WINTER

Revised, improved, water cooled. Saves 25% of coal bill. Changes and Cleans the air in your home 5 times every hour. Build for less than \$18.00 unit costing \$250.00. No better unit ever designed. Send only \$3.00 for detailed plans and specifications or 10c for information. Money back guarantee.

H. W. HERRON, HEATING ENGINEER
1813 W. JEFFERSON ST., ROOM P. S.-2, ROCKFORD, ILL.

BROOKLYN YMCA TRADE SCHOOL

MAIL COUPON

1121 Bedford Ave., Dept. PS. Brooklyn, New York City, N. Y.

Unlimited Instruction until you have mastered every part of Course without additional charge.

Full Shop Equipment Unexcelled Instruction Fireproof Dormitories. Special Privileges. **Check your interests** on attached coupon to receive free literature.

<input type="checkbox"/> Mechanical Pre-Engineering	<input type="checkbox"/> Diesel Engines	<input type="checkbox"/> Oil Burning
<input type="checkbox"/> Diesel Pre-Engineering	<input type="checkbox"/> Aeronautical Pre-Engineering	<input type="checkbox"/> Aviation Mechanic
<input type="checkbox"/> Welding	<input type="checkbox"/> Auto Mechanic	<input type="checkbox"/> Talking Pictures
<input type="checkbox"/> Refrigeration	<input type="checkbox"/> Air Conditioning	<input type="checkbox"/> Television and Radio Mechanic
<input type="checkbox"/> Architectural-Mechanical Drafting	<input type="checkbox"/> Machinist	<input type="checkbox"/> Tool and Die Making
<input type="checkbox"/> Armature Winding	<input type="checkbox"/> Electrical	

Name _____

Address _____

You Should Get Into DRAFTING and Industrial DESIGNING



Get into a Better Pay field with a big future by learning DRAFTING and DESIGNING quickly from an Engineer and Industrial Designer. Private, individual training at your home. Drawing tools and table furnished without extra cost. Learn to draw and design new products, or to improve, re-style, streamline and modernize old products for more "eye appeal" and selling power.

Drafting is a very big field, but drafting with industrial designing is twice as big. Factories must continuously bring out new models, new products, and improved designs. You can learn both subjects right in your own home, in your spare time. You can be trained for better pay as I

have trained many hundred successful students. I'll train you thoroughly by applied instruction on actual work until you are holding a good paying position. Send coupon for full facts on "Drafting and Industrial Designing." **ENGINEER DOBE, Libertyville, Illinois.**

Engineer Dobe, Div. 3392
Libertyville, Illinois.

SEND FOR FULL FACTS

Please send me full facts on "Drafting and Industrial Designing." Also please explain how you assist your graduates to good positions in these fields.

Name..... Age.....

Address

Town..... State.....

Will You Let Me PROVE I Can Make YOU a New Man?

Do you want a powerful body of might and muscle—deep, husky chest—biceps like iron—arms and legs that never tire?

7-DAY TRIAL OFFER

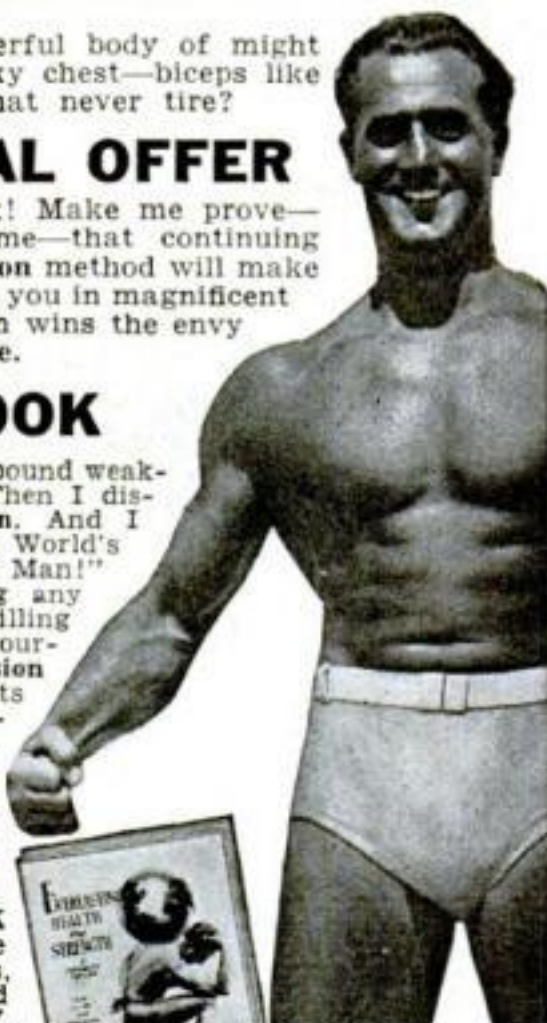
Just give me a week! Make me prove—in even that short time—that continuing with my **Dynamic Tension** method will make a **New Man** of you—put you in magnificent physical condition which wins the envy and respect of everyone.

FREE BOOK

I myself was once a 97-pound weakling—sickly, half-alive. Then I discovered **Dynamic Tension**. And I twice won the title, "The World's Most Perfectly Developed Man!"

But I am not making any claims which I am not willing to have you prove for yourself. If **Dynamic Tension** can't show enough results in a 7-day trial period—results you can see, feel, measure with a tape—then don't go ahead with it—and it won't cost you one cent!

Make me **PROVE** it! Gamble a postage stamp. Send for my **FREE BOOK AT ONCE!** Address me personally: Charles Atlas, Dept. 12, 115 East 23rd Street, New York, N. Y.



MAKE MONEY

WITH NASH CUSTOM TAILORED CLOTHES

Be your own Sales Manager, take orders; earn money with this famous make of clothes. High quality men's tailoring at popular prices.

WRITE! Write in today. Territories open.

THE A. NASH COMPANY

1901 ELM STREET - CINCINNATI, OHIO



MONEY IN RABBITS-CAVIES

WE BUY and put you in touch with other markets. Catalog and copy of magazine 10c. Or send 25c for Book Catalog and Price List and Year's Subscription to the **AMERICAN SMALL STOCK FARMER**. **OUTDOOR ENTERPRISE CO., BOX 922 NEW CITY, N. Y.**

Learn CARTOONING

Make money! Have fun! You can learn at home. —2 complete courses—Cartooning and Cartoon Idea Getting—both for only \$2.80 postpaid. Or send \$1.00, balance C.O.D. Order direct or write for details. **Moon Gag-Cartoon School, Dept. B, Fall Creek, Wis.**



SELL SOAP

Complete Outfit FREE!

Own a steady route; full or spare time. Make money at once and all year 'round with Soaps and many other daily home necessities—over 200 nationally known, guaranteed products. Complete Outfit, including large assortment of full size packages—FREE to reliable persons. Old established company. Write quick for my Free Offer.

E. J. Mills, 1592 Monmouth Ave., Cincinnati, O.



HOLD TEETH TIGHT 50¢

WITHOUT POWDER (PAT. PEND.) Stop falling teeth with DR. BURNETT'S DENTURE LINING. Works under a new principle. Send for trial offer, sufficient for upper and lower plates, 50c postpaid or C.O.D. 65c. Large size package one year's supply \$1.00 postpaid or C.O.D. \$1.20. **POSITIVE MONEY BACK GUARANTEE.** **INLAND LABS, Inc., DEPT. 125 BOX 3346 MERCH. MART, CHICAGO**



VOICE

100% Improvement Guaranteed

We build, strengthen the vocal organs—not with singing lessons—but by fundamentally sound and scientifically correct *silent exercises*... and absolutely *guarantee* to improve any singing or speaking voice at least 100%... Write for wonderful voice book—sent free. Learn WHY you can now have the voice you want. No literature sent to anyone under 17 years unless signed by parent.

PERFECT VOICE INSTITUTE, Studio 1362 64 E. Lake St., Chicago

**BE
SURE
TO
GO!**



NATIONAL HARDWARE

"OPEN HOUSE"

APRIL 25 to MAY 4

VISIT

**YOUR HARDWARE DEALERS
DURING "OPEN HOUSE"**

**WATCH FOR BIG INVITATION
ANNOUNCEMENT IN THE MAY ISSUE OF
POPULAR SCIENCE MONTHLY**

Fun FROM THE START



and SO EASY!

● Just touch a key and blow normally; you can't miss. So easy, and such beautiful tone. Nothing to compare with these new P-A Saxes, Clarinets, Trumpets, and other P-A instruments. Fully guaranteed; your success assured. See your music dealer or write direct for beautiful **FREE BOOK** No obligation. Easy terms. Greatest fun, easiest with P - A.

**FREE
BOOK**

PAN-AMERICAN
204 P-A Bldg. Elkhart, Ind.

Pan-American

Want a Career in Photography?

Ever consider photography as a money-making career? Fascinating field. Fine opportunities. We offer you a thorough, individual training. Commercial, News, Portrait, Advertising, Color, or Motion Picture photography. Learn for pleasure or career. Personal Attendance and Home Study courses. Free booklet.

NEW YORK INSTITUTE OF PHOTOGRAPHY
10 West 33 Street (Dept. 5) New York City

LEARN AVIATION

IN LOS ANGELES - Nation's Aviation Capital
Huge increase in Los Angeles aviation activity has assured splendid positions for graduates. Career training offered for airline piloting, engineering, mechanics, drafting, production mechanics and instruments. Train at one of America's most modern equipped and strategically located schools; fully approved by the government as a ground, flight and mechanics school. Write for free new 64 page catalog.
CALIFORNIA FLYERS
SCHOOL OF AVIATION - Dept. PS-2
LOS ANGELES MUNICIPAL AIRPORT, INGLEWOOD, CALIF.

ENGINEERING

DEGREE IN TWO YEARS
TECHNICAL AND APPLIED COURSES. Nonessentials omitted. TIME AND MONEY SAVED. Degree 2 yrs., diploma 1 yr. Electrical, Mechanical, Architectural, Structural, Civil, Aeronautical, Highway. All courses include Air Conditioning, Electric Refrigeration and Diesel. Short intensive courses 3 and 4 months in Electricity, Power plant, Diesel-Electric, Electric Refrigeration, Drafting. Extensive modern equipment. **LOW TUITION.** Part-time work for room and board. Thousands of successful graduates in U.S. and foreign lands. Approved by Industry, endorsed by educators, recommended by alumni. One and two-year courses start in Sept., short courses open year round, 40th YEAR. Residence courses. Catalog free.
FINLAY ENGINEERING COLLEGE
1003 Indiana Avenue Kansas City, Mo.

Big Money for Workers In Home or Shop

MAKE color-glazed concrete products, gravestones, tiles, walls, floors, lawn, cemetery pottery. Basement water-proofing. New, patent method. Use only sand, cement, cheap materials. No skill required. Operators wanted everywhere. Full or part time. Big earnings. Send 10c TODAY for booklet, cost data, details. No obligation.
NATIONAL POTTERIES COMPANY
Dept. 7, 13 W. 26th St. Minneapolis, Minn.

Learn Public Speaking
At home—in spare time. Many overcome "stage-fright," gain self-confidence and increase earning power, this easy way. Write for free booklet, *How to Work Wonders With Words* and requirements.
North American Institute, Dept. 1362
3601 Michigan Ave., Chicago, Illinois

WORLD'S LARGEST LABORATORY MAKING DENTAL PLATES ONLY!

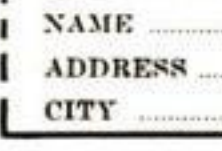
TRANSPARENT **ROOFLESS** **PARTIAL**
60 Days' Trial! We make **FALSE TEETH** that fit you by mail from your mouth impression. Thousands of satisfied customers. Money back guarantee. Save 1/2 or more. Free mouth-forms, directions. Write **U.S. DENTAL CO., Dent. 2-42, Chicago, Ill.**

\$685 to \$35



Turns SPARE HOURS INTO CASH!

up to \$40 Weekly In Your Own Home



No soliciting! No canvassing! We show you how to make big money decorating fast-selling Giftwares. We start you with the big \$10 Artist's Outfit shown above. We supply you with \$150 worth of Giftwares free of extra charge and show you how to dispose of them without leaving your home. We give you 29 Tested Plans for making money. One Fireside Member says, "I made \$100 on furniture in one week." Another writes, "My sales were \$500 for 5 weeks. This is my first year." R. M. P., of Ill., says, "I did \$3,500 worth of business last year and over \$12,000 this year." D. W., New Mexico, reports, "I would not take \$1,000 for my Course."

No Experience Needed

You too may have a splendid income opportunity with Fireside. No tiresome study. You learn by doing. No artistic ability necessary. Our easy 3-Step Method makes the work easy to learn and easy to do and fits you to make good money practically from the start.

Quick Sales in Your Home

No need to leave the house. Our new automatic sales cabinet does all the selling for you. Designed to quickly find cash buyers for your Giftwares.

No Cost Plan

Mail coupon for Free Plan showing how to earn your course and Big Profits besides.

FIRESIDE INDUSTRIES
Dept. 51-B
Adrian, Mich.

FREE!
Book on decorating at home for big money. Tells how to get big assortment beautiful Giftwares free of extra charges.

Fireside Industries
Dept. 51-B, Adrian, Mich.
Send me FREE Book on Home Decorating for good earnings. Also details of plan that will pay for short training and to give me big profits besides.

NAME _____
ADDRESS _____
CITY _____ STATE _____

Please mention POPULAR SCIENCE when writing to advertisers.

NEW IDEAS FOR Home Mechanics



Compressed air forces fertilizer into soil around drilled holes

Fertilizer Shot into the Soil

AN EASY way to distribute fertilizer through a lawn, flower bed, or vegetable plot is to blow it into the ground by means of a novel compressed-air apparatus. Used to insure luxuriant growth in Westlake Park, in Los Angeles, Calif., the system is applicable to smaller areas around homes. One workman uses a long drill to bore holes throughout the area to be fertilized, and another follows him with the compressed air machine, as shown in the photograph at the left. Fertilizer poured into the funnel-shape opening of the device, is forced by compressed air throughout the soil surrounding the drilled hole.

Kit Has Tools for All Home Repairs

HOUSED in a sturdy, compact wooden box, a handy and economical kit just placed on the market was designed to furnish the home owner with all the tools and supplies needed to perform practically any kind of repair job around the home. Only seventeen inches long, the portable unit contains pliers, a plane, folding rule, file, pipe wrench, hammer, saw with three removable blades, chisel, small vise, ratchet screw driver, and other useful tools. Small shelves built into the box cover accommodate fifteen transparent, unbreakable containers filled with assortments of wood screws, nails, hooks, screw eyes, washers, tacks, nuts, bolts, and other items. The cover of the outfit is fastened



This household kit contains tools and supplies for home repairs. Below, kit closed for carrying



with a leather strap which serves as a handle for carrying the kit to the part of the house where it is needed, as shown in the photograph at the right.

DRUM YOUR WAY TO FAME AND FORTUNE!

Begin now to be a big-name drummer. A money-making career awaits you if you will plan now, *today*, to master the drum...it's easy, requires no long study, comes naturally. Start with a **GRETSCH DRUM**, chosen above all others by Bernie Mattinson and dozens of other star drummers. Lots of fun learning, easy to pay on liberal GRETSCH terms.



BERNIE MATTINSON
with HORACE HEIDT

Send penny postcard for **FREE DRUM Catalogue** and full information about **EASY-PAYMENT Plan** and **FREE TRIAL**. Please give street address and send to Dept. PS 21.

The FRED. GRETSCH MFG. CO.
Musical Instrument Makers Since 1883
60 BROADWAY, BROOKLYN, N. Y.

**EASY
TO
PLAY
★
EASY
TO
PAY**

GRETSCH also offers **SUPER VALUES** in Guitars, Saxophones, Trumpets, Trombones, Accordions. Send for **FREE catalogue**. Mention instrument.

\$100 for a Name!



Burpee's NEW "Nameless" TOMATO

So wonderful, we cannot find a name good enough! You may suggest just what we want, and *earn \$100*; you have until September 10. Read how in 160-page 1940 Burpee's Seed Catalog—free on request.

Giant 7 to 8½ oz. fruits, smooth, scarlet, luscious. Round, solid, thick meat. **100 Seeds for 10c; 300 for 25c; 1500 for \$1.** Postpaid, write today!

W. Atlee Burpee Co., 671 Burpee Building, Philadelphia

EARN EXTRA MONEY at Home



Increase your income at home by new, simple Wentworth Tempera Color method. We instruct you and supply you with work. Write today for **FREE BOOKLET**.

Wentworth Pictorial Co. Ltd. DEPT. 465, Hamilton, Ont.

MAIL ORDER BUSINESS

Your Big Opportunity!

Learn how to make money from home or office, spare or full time. Up-to-date copyrighted home study course. Widely endorsed. Teaches professional mail order technique; not penny-catching schemes. Sound instructions by successful money-making experts. Write for **FREE details today**. No obligation.

NELSON CO., B-402 Manhattan Bldg., Chicago.



CUT ME OUT

Cut me out, paste me on a postcard and mail to Popular Science Monthly, Dept. 20C, 353 Fourth Ave., New York, N. Y. I'll bring you complete supplies and instructions on how to make easily several dollars a week in your spare time.



Midget radio fits your pocket or purse. Weighs only 4 ozs. Smaller than cigarette package! Receives stations with clear natural tone. **NO CRYSTALS to adjust—NO UPKEEP—only one moving part. TUBELESS, BATTERYLESS, ENTIRELY NEW PATENTED DESIGN.** Has enclosed geared luminous dial for perfect tuning. Many owners report amazing reception and distance.

ONE YEAR GUARANTEE Sent complete

ready to listen with instructions and Tinyphone for use in homes, offices, hotels, boats, in bed, etc. **TAKES ONLY A SECOND TO CONNECT—NO ELECTRICITY NEEDED! SEND NO MONEY!** Pay postman only \$2.99 plus postage on arrival or send \$2.99 (Check, M.O., Cash) and yours will be sent complete postpaid. A most unusual value. **ORDER NOW! MIDGET RADIO CO., Dept. PS-2, Kearney, Nebr.**



High School Course at Home

Many Finish in 2 Years

You can complete this simplified High School Course as rapidly as your time and abilities permit. Equivalent to resident school work—prepares you for entrance to college. Standard H. S. texts supplied—Diploma. Credit for H. S. subjects already completed. Single subjects if desired. High School education is very important for advancement in business and industry and socially.

College Entrance

During the past 14 years, our High School graduates have been admitted to 531 different Universities, Colleges, Junior Colleges and Normal Schools—80% of them without entrance examination. Course also prepares for teachers' certificate and pre-professional examinations.

Business—Industry

To get and hold a good position in Business today you must be able to write clear, accurate letters and reports—do figuring involving Algebra and Geometry—talk intelligently on matters requiring a knowledge of Geography, History, and Economics.

In Industry—Mechanical and Engineering lines—you must have at least an elementary knowledge of Physics and Chemistry—be able to figure quickly and accurately—know something of Mechanical Drawing and blueprints—and be able to talk and write accurately and clearly on both your work and ordinary topics of conversation.

Our High School course meets the preparatory educational requirements for Business and Industry.

An Educational Institution

The American School was chartered in 1897 as an educational institution, not for profit—and is exempt from paying Federal income tax, like the best resident colleges and universities.

Don't Be Handicapped— Complete Your Training Now

Be a High School Graduate! Prepare yourself for promotion in Business and Industry—for the Professions, College Entrance and social success. No matter what line you may select, High School training will prove invaluable to you!

20 Other Courses

Over 150 noted Educators, Engineers, and Business Men helped prepare our special instruction material, which is used by many resident schools and colleges, U. S. Navy, and Province of Manitoba, Canada. We offer you quality training at home for the best-paying lines of Industry and Business, as listed in the coupon.

Our moderate fees cover all instruction, standard textbooks and Diploma. Easy monthly terms. Get ahead in life. Start your training NOW!

Mail coupon for information about line that interests you

American School, Drexel at 58th, Chicago

American School, Dept. H-246 Drexel at 58th, Chicago

Tell me how to train for success in line checked. No obligation.

- | | |
|----------------------------------------------------|----------------------------------------------------|
| <input type="checkbox"/> High School Course | <input type="checkbox"/> Diesel Engineering |
| <input type="checkbox"/> Accounting & Auditing | <input type="checkbox"/> Drafting & Design |
| <input type="checkbox"/> Architecture & B'ldg | <input type="checkbox"/> Liberal Arts |
| <input type="checkbox"/> Automotive Engin'ring | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Hl'er Ac't'g (C.P.A.) |
| <input type="checkbox"/> Com'ercial Aeronautics | <input type="checkbox"/> Highway Engin'r'g |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Mechanical Eng'r'g |
| <input type="checkbox"/> Electrical Refrigerat'n | <input type="checkbox"/> Radio & Television |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Steam Engineering |
| <input type="checkbox"/> Complete Law | |

Name.....

Address.....

\$10⁰⁰ SAVED per dollar spent—a fair average for SMOOTH-ON No. 1

Smooth-On No. 1 has a value far out of proportion to its ridiculously low material and application cost, and invariably pays a very high return to the householder who does his own tinkering. Home mechanics appreciate the ease of making Smooth-On repairs (without heat or special tools), the quick readiness for full-capacity service, and the reputation for competency which these repairs give to those who make them. Every one likes the speed with which a Smooth-On job gets things in good working order again after a breakdown or leak has caused annoyances.

The performance of Smooth-On No. 1 has been stepped up to meet every demand in stopping a leak or tightening a loose part, and recent changes in the composition also make application easier than ever. Used judiciously, Smooth-On No. 1 can be depended upon for a repair that is perfect **and permanent**.

All that would be used in the home in a year usually costs less than the saving in a single simple application, and if you fail to utilize Smooth-On economies, you overlook one of the best opportunities to make household savings. Keep Smooth-On No. 1 and the Smooth-On Handbook in your workbench. The helpful ad-

vice, instructions, and working diagrams in the book afford a reliable guide, based upon good engineering practice.

Get Smooth-On No. 1 in 7-oz. or 1 or 5-lb. can from your hardware store or direct from us.

SMOOTH-ON CEMENTS

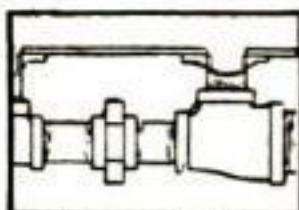


for the Motor Car and Boat, Home, Factory and Power Plant

Write for FREE BOOK



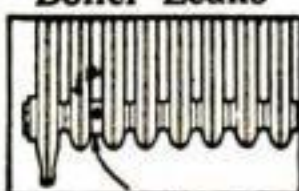
Do it with **SMOOTH-ON**



Pipe Leaks



Boiler Leaks



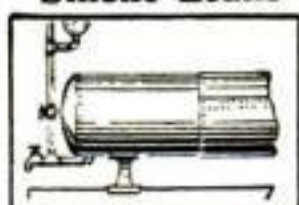
Radiator Leaks



Fire Pot Leaks



Smoke Leaks



Tank Leaks



Furnace Gas Leaks

SMOOTH-ON MFG. CO., Dept. 58
574 Communipaw Ave.,
Jersey City, N. J.

Please send Smooth-On Repair Book.

Name

Address

2-40

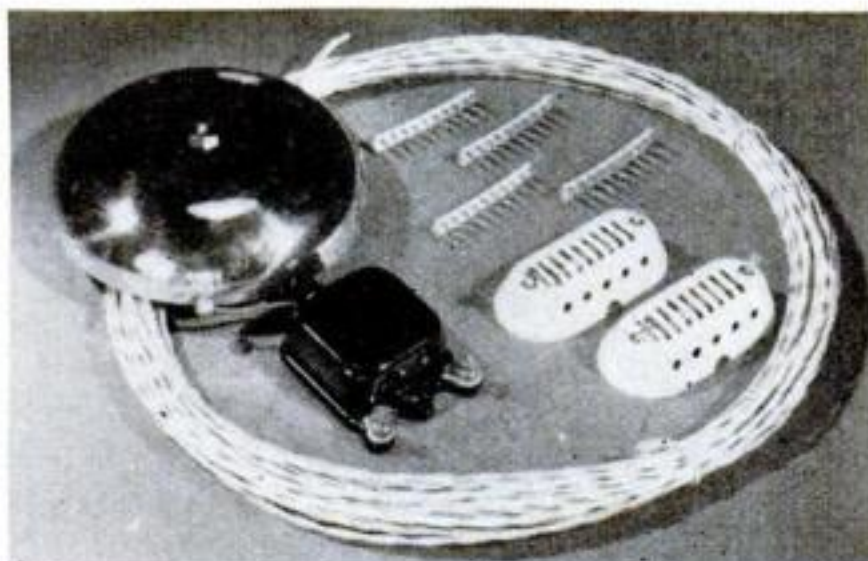


Novel Joint in Wall Board Hides Nails

A NEW tongue-and-groove edge now makes it easy to conceal the joints between adjacent panels of a well-known make of insulating wall board. The board edge has a tongue section at one end and a groove at the other. The board is nailed in place through the grooved end, and the tongue section of the adjoining panel slipped into place, the latter panel's grooved end being in turn nailed fast. All nailing is thus concealed.

Fire Alarm for the Home

INSTALLED as easily as an electric door bell, the household fire alarm shown below operates on four dry cells. Supersensitive thermostatic switches, installed where hazards are greatest, detect the first sign of a fire and cause the gong to sound.





Use this New Royal Portable in your own home **FREE**

READ WHAT OWNERS SAY:

"Earn more money—make that correspondence course pay real dividends" (Sales engineer)...
"Get ahead faster—make home work count" (A student)...
"A real help to everyone in the family." (Housewife)

SEND NO MONEY—don't spend a cent—until you *know* that a New Royal is going to be worth many times its cost to you. *Know* how easy it makes writing—how its many office typewriter features and controls help *you* turn out neat, accurate business-like letters and reports. Maybe you've never used a typewriter—never thought of owning one... Then you owe it to yourself, to your future, to clip the coupon *at once* and get the **FACTS**. No obligation.

*Trade-mark, Reg. U. S. Pat. Off.

ACT NOW!... NO OBLIGATION

FREE



Instant Typing
Chart. *Only*
Royal has it!



YOURS!

The Duo-Case!
With every Royal
Portable—at
no extra price!



WITH MAGIC*Margin New! Sensational! Sets margin automatically 3 times faster.

Royal Typewriter Company, Inc.
Dept. D-207, 2 Park Avenue, New York, N. Y.

Tell me how I can get a genuine New Royal on **FREE HOME TRIAL**, also, how I can own one for **ONLY A FEW CENTS A DAY**.

NAME _____ STREET _____

CITY _____ COUNTY _____ STATE _____

MAKE THAT OLD TYPEWRITER HELP PAY!

Please quote trade-in allowance on a _____ Typewriter, Serial No. _____

I'M GLAD I BOUGHT AN IDEAL LAWNMOWER SHARPENER AND WENT INTO BUSINESS FOR MYSELF . . .

**You, too, can have a profitable
business of your own . . .**

Our free plans show you how to build a successful business of your own sharpening lawnmowers. Most men earn up to \$25 a week, even in spare time. Howard Hellen, Minn., writes, "I sharpened 745 lawnmowers, sold 60 used mowers and grossed \$1100.00 from April 5 to Sept. 15." Roy F. Stier, Wisc., writes, "I paid for my Ideal Sharpener in exactly 36 days." Like magic, the Ideal Lawnmower Sharpener makes old, dull, badly worn mowers cut like new. Simply set the mower in the Ideal, make a few simple adjustments and the machine does the rest. Sharpens any mower to perfect edge in 15 to 20 minutes—usual charge \$1.00 to \$1.50. Attach to light socket. Start in your basement or garage. Work spare time or full time. Attachments for grinding skates, grass shears, hedge shears, sickles, scythes and axes. **FREE CATALOG** tells complete story.

THE FATE-ROOT-HEATH CO.
250 Bell St. Plymouth, Ohio



Make Money! SHARPEN LAWMOWERS THE "IDEAL" WAY!

**FELLOWS-YOU'VE
SEEN ALL THESE
DIESELS---**



**WHAT ARE YOU DOING
ABOUT THEM?**

* * Everywhere you look you can see Diesels forging ahead—new types for trucks, busses, trains, boats and general industry. You've seen the ads of world-known firms announcing their entry into Diesel—magazines making Diesels the subject of their feature articles. Never before has there been greater activity in this field. * * But are you connecting your future with the inevitable growth of this great industry? * * Find out about it—start doing so by sending for free copy of *March of Diesel*, and data on Hemphill Diesel training. Use coupon now.

HEMPHILL DIESEL SCHOOLS

All communications concerning enrollment in any of the Hemphill Diesel Courses should be sent to one of the following addresses:

NEW YORK . . . 31-32 Queens Blvd., L. I. C.
CHICAGO . . . 2006 Larrabee Street
MEMPHIS . . . 431 Monroe Avenue
LOS ANGELES . . . 2012 San Fernando Road
VANCOUVER, B. C. . . . 1365 Granville St.

HEMPHILL DIESEL SCHOOLS (use nearest address)

Please send data on your Diesel courses, also free copy of illustrated booklet "March of Diesel."

Name _____ Age _____

Street _____

City _____ State _____ M-42-S

Applications for enrollment will be accepted from English speaking students residing in foreign countries. Write for special terms.

Questions FROM HOME OWNERS

Q.—WE HAVE an upstairs bedroom floor which has been used off and on for fourteen years, and the hard pine flooring has dried out, leaving cracks between the boards. How should these be filled in? Should they be filled before or after the floor is sanded?—J. M., Meadows, Ill.

A.—IF THE cracks are not too wide, they can be filled with a mixture of sawdust and varnish. Wide cracks should be filled with strips of wood cut to fit and glued in place. There is also on the market a powdered filler which is mixed with water. The floor should be sanded before the cracks are filled, as this will remove many of the smaller imperfections. If the floor is very splintery, it would be wise to rent a floor-sanding machine. After the cracks have been filled, the floor should be given a second sanding to remove any rough spots and give the floor a smooth, finished look.

Natural Finish for White-Pine Walls

Q.—I AM building a small house with an outside wall surface of about 2,000 square feet. I plan to use white-pine boards and battens, and instead of using house paint or stain, I want to use a clear, colorless finish that will preserve the beauty of the natural wood and prevent its discoloration. What would you advise?—H. E. A., Detroit, Mich.

A.—WE SUGGEST that you use a very high-grade outside spar varnish or a high-grade marine spar. Thin the first coat with turpentine and apply over this at least two and preferably three coats of full-bodied varnish. This will darken the wood to some extent, but will give a durable finish with the beauty of natural wood, just as it does on yachts and small boats.

Painting Crumbly Plaster

N. O'D., CHILLICOTHE, OHIO. When painting a plaster wall whose surface tends to crumble, all surface powder should first be removed with a painter's duster or a large bristle brush, taking care not to mar the surface. Then apply a coat of varnish size, following this with a priming coat of flat wall paint or a mixture of half flat wall paint and half size. Finish with two or three coats of regular paint, just as you would with any other plaster wall, but do not apply it heavily.

I'M SO HAPPY NOW
THAT CHARLES IS
DOING SO WELL IN HIS
NEW BUSINESS



**MADE \$217
in 10 DAYS
WASHING WALLS**

● Newly invented machine washes walls 6 times faster and better than by hand.

Charles Steele made \$217.00 the first 10 days. We want more men like him to go into business for themselves. Customers everywhere — homes, schools, offices, stores, churches, lodge halls, hotels all have walls that need washing. You don't rent a store or office; you operate this business from your home. On a job paying you \$10 your cost is 20c. Write for complete facts on new Von Schrader Wall Deterger which washes paint perfectly and postpones repainting many years.

Howard James writes:
"I landed a \$40.00 job the first day."

J. A. Crosby says: "I have several jobs to start on Monday, thanks to your help."

Cliff Brown writes: "I got a contract in a public school which will more than pay for my machine in the next few days."

VON SCHRADER



Easy Payments

It takes only a few dollars to get started in this new money-making profession. No experience necessary. The total price is so small and the payments so easy that anyone with ambition should get started NOW.

**SEND FOR FREE
INFORMATION**

MANUFACTURING CO.

782 PL. RACINE, WISCONSIN

DIESEL

Maximum training minimum time; practical and theoretical. Modern equipment, experienced teachers. Personal instruction. 40th year. Catalog free. Residence course in three months.

FINLAY ENGINEERING COLLEGE, 1005 Indiana, Kansas City, Mo.



ITALIAN ACCORDIONS

HAND MADE. Very best. Lowest prices. Direct from Factory Representative. Send your name and address for FREE catalog.
ITALIAN ACCORDION COMPANY
323 W. POLK ST., DEPT. 0-1, CHICAGO, ILL.

FORGE AHEAD

with the Thinking Alphabet "exactly how" short cut for training mind and personality. Helps gain Originality... Self Discovery... Personal Power... Achievement. Free booklet. Thinking Alphabet Institute, 99-A Fern St., Philadelphia.

When Writing Advertisers
Please Mention POPULAR SCIENCE

COSTS

PROFITS

APPROPRIATIONS

TAXES

POLICIES

AUDITS

PLANS FOR
FINANCING

Become an Expert Accountant

The Profession that Pays

The demand for skilled accountants — *men who really know their business* — is unceasing. Big corporations are in constant need of expert counsel in Auditing, Cost Accounting, Business Law, Organization, Management, Finance. Men who prove their qualifications in this important branch of business are often promoted to responsible executive positions — given an opportunity to earn real salaries.

Send for This Book — It's Free

Are you ambitious to make a real success in business — to fit yourself for positions paying \$3,000, \$5,000, \$10,000 a year and even better? Then you will find LaSalle's 48-page book, "Accountancy, the Profession that Pays," of the greatest help and inspiration — and — LaSalle will send it to you FREE. For the sake of a brighter future, clip and mail the coupon NOW.

----- Find Yourself Through LaSalle! -----

LASALLE EXTENSION UNIVERSITY

A CORRESPONDENCE INSTITUTION
Dept. 283-HR Chicago

I should be glad to have details of your *salary-increasing plan* and a copy of "Ten Years Promotion in One," all without obligation.

- | | |
|------------------------------------------------|------------------------------------------------|
| <input type="checkbox"/> Higher Accountancy | <input type="checkbox"/> Modern Foremanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> C. P. A. Coaching |
| <input type="checkbox"/> Modern Salesmanship | <input type="checkbox"/> Effective Speaking |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Stenotypy-Stenography |
| <input type="checkbox"/> Law—Degree of LL.B. | |
| <input type="checkbox"/> Commercial Law | |
| <input type="checkbox"/> Industrial Management | |
| <input type="checkbox"/> Expert Bookkeeping | |
| <input type="checkbox"/> Modern Business | |
| <input type="checkbox"/> Correspondence | |
| <input type="checkbox"/> Credit and Collection | |
| <input type="checkbox"/> Correspondence | |



Name.....Age.....

Present Position.....

Address.....

AVIATION WANTS MORE LINCOLN TRAINED MEN



Now is the time to get into Aviation! Airlines, Airports, Airplane Factories now expanding, must have thousands more trained men. Graduates of this **Lincoln Government Approved School** are regularly stepping into good-pay positions in Aviation! Opportunities for many more! **BE A SKILLED WELL PAID PILOT.** Learn here to fly fast modern airplanes. 14 Training Planes; 5 types, provide wide piloting experience. Your training here is Government Approved every step of the way. Prepares you for your official Government Rating as Private, or Commercial, Pilot with Pilot Instructor's Rating.

BE AN AVIATION MECHANIC or AERONAUTICAL ENGINEER. Learn Airplane and Engine Maintenance, rebuilding and repair; Airplane Design and Construction; Aircraft Sheet-Metal or Welding. We teach you. Big demand for engineers, draftsmen and skilled mechanics. Big money paid! 134 Lincoln Graduates recently placed in good positions. **EMPLOYMENT SERVICE GIVEN.** We assist Graduates in locating positions. Now offering part-time employment for board and room while in training.

MAIL COUPON NOW for complete information.

LINCOLN AIRPLANE & FLYING SCHOOL
622 AIRCRAFT BLDG., LINCOLN, NEBRASKA



LINCOLN AIRPLANE & FLYING SCHOOL
622 Aircraft Bldg., Lincoln, Nebraska.

I'd like to get into Aviation. Please rush complete information about Lincoln Training.

Name.....Age.....

Address.....

City.....State.....

FIND YOUR HOBBY

... THEN ORDER THE BOOK OR BOOKS SUGGESTED FROM THE DESCRIPTIONS BELOW!

THESE BRAND NEW MANUALS ARE THE VERY NEWEST AND LATEST GUIDE BOOKS PUBLISHED

Fully illustrated and bound in sturdy cloth. They are an unbeatable value at only \$2.00 each.

BOOK 1 JIG-SAWING PROJECTS

How to make ingenious toys with the jig saw. Plans for making puzzles, book ends, racks, door stops, bird houses, comical animals and figures, plaques, wooden flowers, and other interesting projects. Fully illustrated, cloth-bound \$2.00.

BOOK 3—CHEMICAL FARMING FOR AMATEURS

Everything you need to know about growing flowers, fruits, and vegetables by means of chemicals. Water, sand, and cinder methods of culture. How to build small tanks for the home and large systems for commercial use, circulators, aerators, other apparatus. Chemical formulas for mixing solutions. Fully illustrated, cloth-bound \$2.00.

BOOK 4 DESIGNER AND DRAFTSMAN

A simple system of diagrams that will enable you to design plans for the things you want to build. How to make your own drafting outfit, drawing-board, etc. Mechanical drawing simplified. An easy system of lettering. How to make blue prints. Fully illustrated \$2.00.

BOOK 6—HOW TO GET A BETTER JOB

Letters, interviews and applications that win the better jobs. Specimens of effective letters for top jobs. How to answer ads with letters that get interviews. Analyses of application forms of leading employers—how to fill them out. Sixteen leading employment managers collaborated to produce this helpful book. Cloth-bound \$2.00.

BOOK 7 GARDEN GUIDE

Everything you need to know about your garden in concise form. How to plant and care for flowers, shrubs, vegetables and trees. How to plan your garden. How to grow and care for your lawn. How to lay out a rock garden. Fully illustrated \$2.00.

BOOK 2 SOLDERING

How to repair jewelry, candlesticks, vases, etc., with silver and gold solder. How to solder cast iron, aluminum, and other difficult materials. How to use soft solder for practical and decorative work. Fully illustrated, cloth-bound \$2.00.

BOOK 5 PLASTIC MODELING

How to fashion realistic animals and figures from modeling clay. How to make efficient wire skeletons to simplify your work. Plaster casting. Keene's cement work. Glue and rubber molds. How to make puppets and masks. How to model in clay from life. Fully illustrated \$2.00.

BOOK 8 TOY MAKING FOR FUN AND PROFIT

Simplified instructions for making wheel toys, doll houses and furniture, animated toys, construction toys, animals and birds. How to make games, boats, equipment for winter and summer sports. Fully illustrated, cloth-bound \$2.00.

IF YOUR HOBBY IS ...

	ORDER BOOK NUMBER
METAL WORKING	2, 11
GARDENING	3, 7
WOODWORKING	1, 9, 10
DRAWING	4
MODELING	5
HOME REPAIRS	10
TOY MAKING	8, 11
CHEMICAL FARMING	3
BOATS	9
GASOLINE POWERED MODELS	11
DO YOU WANT A BETTER JOB?	6

BOOK 9 BOOK OF BOATS

Complete plans and specifications for building a 17-ft. cabin cruiser, a fast 14-ft. V-bottom skiff, a low-cost 11½-ft. fisherman's boat, a sturdy 16-ft. lightweight kayak and six other inexpensive boats for racing, cruising and general use. Fully illustrated, cloth-bound \$2.00.

BOOK 10 HOME OWNER'S MANUAL

How to make repairs from cellar to chimney top. All about painting, finishing, papering, woodworking, masonry, plumbing, heating, etc. Fully illustrated, cloth-bound \$2.00.

BOOK 11—GASOLINE POWERED MODELS

How to make model boats, automobiles, planes and gasoline motors to run them. A homemade wind tunnel to test the streamlining of fuselages, hulls, etc. Fully illustrated, cloth-bound \$2.00.



SEND NO MONEY MAIL THIS COUPON

Popular Science Monthly, Dept. 20
353-4th Ave., New York

Please reserve in my name, and notify me when the books I have circled below are ready for shipment.

- | | |
|---------------------|---------------------|
| 1. Jig-Sawing | 6. Get a Better Job |
| 2. Soldering | 7. Garden Guide |
| 3. Chemical Farming | 8. Toy Making |
| 4. Designer | 9. Book of Boats |
| 5. Plastic Modeling | 10. Home Owners |
| | 11. Gas Models |

I will pay the postman \$2.00 each, plus postage on delivery. You will refund my money if I return the books in 10 days.

NAME _____ A

ADDRESS _____

CITY _____ STATE _____

Decidedly Unusual— THURSTON'S 1940 CATALOG OF "HARD-TO-GET" MATERIALS

For Homecrafters, Schools, Institutions,
Antique, Novelty and Cabinet Shops

A few of the items we show: Chest hardware, locks, hinges, supports, casters, copper trim, etc., also mldgs., overlays, etc. Finishing materials, glue, stains, varnish, wax, flint and garnet papers, rubber sanding blocks, stick shellac, burning-in knives, etc. Upholstering supplies and coverings. Complete line of electrical findings for lamp manufacture, also cluster and indirect fixtures. Chair cane, woven and in strands, splines, reeds, fibre cord, etc. Trays for smoking stands and glass liners. Large line electric and spring clock movements, with and without dials. Complete line Venetian Blind hardware, tapes and cords. Table slides and leaf supports. Tea wagon wheels and casters. Wood dowels, also dowel screws, dowel centers, wood screw hole buttons. Excellent line card table leg supports. Red hardware of every description. Desk pens, complete with funnel and fastening, without base. Water transfers, inlays, small mouldings, etc. Furniture glides and casters, office chair spiders, wood legs and K. D. chair frames. Small box hardware of every description. Large selection pulls, knobs, handles, hinges, locks, catches, etc. Perforated steel panels, chair braces, revolving chair fixtures, rocker springs, candlestick sockets, bill board clamps, banquet table equipment, many sizes braces, corner irons, hanger bolts. Step ladder braces, pilaster strips, sliding track and sheaves. Typewriter desk hardware, binwings, mirrors, nut bowl hardware. Bar pins for novelties. Catalin Plastics. Crib hardware, swivel top table fixtures, sectional bookcase hardware, clamp nails, electric pens for burning, etc., etc. Send 10c cash or stamps.

Thurston Supply Company, Dept. P. S., Anoka, Minn.

Landscaping Is Profitable Fascinating Career or Hobby for Men and Women

Send for free book giving details of Landscape Gardening course! Train yourself at home, in spare time, for fascinating profession of Landscape Architect, or to get more out of your gardening hobby. H.S.M. writes, "My annual income is \$4000. Your course paid me well." Send postal today for "Success Thru Landscape Training."

AMERICAN LANDSCAPE SCHOOL
6154 Grand Ave. Des Moines, Ia.

RADIO

—covering the Basic Principles—Construction & Operation—Service—Repairs—Troubles—All Easily Understood. Over 750 Pgs.—400 Illustrations, Parts & Diagrams—LATE TELEVISION DATA—Valuable for Reference & Home Study. To get this information for yourself send postal card today for FREE RADIO FOLDER. Complete book \$4 postpaid only \$1 monthly. Money back if not satisfied

AUDEL, Publishers; 49 W. 23rd St., NEW YORK

ARTISTS MAKE MONEY

Find out your ability. Send name, age, occupation and address for Free Vocational Art Test.

Federal Schools, Inc., 2140 Federal Schools Bldg., Minneapolis, Minn.

DRAFTING PAYS BIG

Drafting Jobs Often Pay \$175.00-\$500.00 month. Trained draftsmen always in demand. Learn easily at home in spare time. Experience unnecessary. Common education enough. Employment service FREE. Write today for complete information. No obligation.

MONROE INSTITUTE. Dept. B-102. Alton, Illinois

When Writing Advertisers

Please Mention POPULAR SCIENCE

Rheumatism Relieve Pain in Few Minutes or Money Back

To relieve the torturing pain of Neuritis, Rheumatism, Neuralgia or Lumbago in a few minutes, get NURITO, the fine formula, used by thousands. No opiates. Does the work quickly—must relieve cruel pain to your satisfaction in a few minutes—or your money back. Don't suffer. Clip this ad now as a reminder to ask your druggist for NURITO today.

New MIRACLE WALL CLEANER

AGENTS HOT SELLER!

Saves Costly Redecorating!

AMAZING INVENTION. Banishes old-style housecleaning mess and fuss. No rags—no sticky "dough"—no red, swollen hands. No more dangerous stepladders. Literally erases dirt like magic from walls, ceilings, window shades, upholstered furniture, etc. **Ends drudgery! SAVES REDECORATING!** Approved by Good Housekeeping. Low priced. Housewives wild about it. **AGENTS WANTED EVERYWHERE.** Samples sent on trial to first person in each locality who writes. No obligation. Get details. Be first—send in your name TODAY!

THE KRISTEE PRODUCTS CO. 616 Bar St. Akron, Ohio

FREE CATALOG

BRINGS YOU MORE FUN IN RADIO AT LESS COST!

GET AN EYEFUL of this FREE book full of values in radios, parts and equipment. 188 jam-packed pages. All the nationally advertised names. 64 receiver models alone to choose from. Sensational "Build-It-Yourself" Kits that double the thrill of owning a radio, and cut the cost in half. Prices consistently lower on everything—from the tops in phonograph-radio combinations to the latest type tubes. Wherever you are, you can order at home... save time and money. Every item guaranteed. Send for this big FREE catalog today. Have more fun in Radio. Mail this coupon NOW!

NEW YORK, N. Y.
100 SIXTH AVENUE
CHICAGO, ILL.
901 W. JACKSON BLVD.
ATLANTA, GA.
265 PEACHTREE ST.
BOSTON, MASS.
BRONX, N. Y.
NEWARK, N. J.
JAMAICA, L. I.

LAFAYETTE RADIO

Radio Wire Television Inc.

Dept. 9B—100 Sixth Ave., New York, N. Y.

Rush FREE 1940 Radio Catalog No. 78

NAME _____

ADDRESS _____

CITY _____

STATE _____

**WORLD'S
FINEST
RADIO
CATALOG
FREE**

PASTE COUPON ON PENNY POSTCARD

HOT WATER SPEED KING



From Any Electric Light Socket

MILLIONS of homes, stores and offices everywhere need SPEED KING—the new, amazing Water Heater—that heats water boiling hot so fast it takes your breath away. No muss! No waste of time or fuel! Just a simple "plug-in" at any 110-volt light socket—and presto... just the amount of hot water you need for washing, for shaving, for dishwashing. **CHEAPER** because you don't have to heat gallons when you need only a few quarts. **FASTER** because the intense electric heat goes directly into the water. Sells fast on a 60-second demonstration. Small in size—fits the pocket, easy to carry. Anyone can afford it.

**60-SECOND
Demonstration
Amazes Housewives**

SAMPLES for AGENTS

I WANT you to know the almost uncanny heating action of this speedy water-heating invention. Write quick for my sample offer—a postcard will do. Get an actual sample SPEED KING for making demonstrations. You can make plenty of cash as my agent. **HURRY!** Big season starting now. **SPEED KING** solves the hot water problem when furnaces shut down. Act quick and I'll show you how to make the fastest money of your life. Send No Money!—Just your name.

NU-WAY MFG. COMPANY
Dept. 132, Walnut Bldg., DES MOINES, IOWA

**JUST SEND
"NAME"**

WRITE your name and address in the margin, clip & mail this coupon or send penny postcard to Dept. 132.

Name

Address

City

Please mention POPULAR SCIENCE when writing to advertisers.

MAKE POULTRY PAY YOU A GOOD LIVING FOR LIFE



**POULTRY RAISING
PAYS GOOD PROFITS FOR
THOSE WHO KNOW ITS SECRETS**

Healthful, interesting occupation for whole or part time in country, village or city suburbs. Open to young and old. Win independence of low wages, uncertain employment, uncivilized labor, with a Poultry Business of your own.

PROVED METHODS BRING SUCCESS FROM START

Harry M. Lamon, nationally known Poultry Expert, former Senior Poultryman U. S. Dept. of Agriculture, quickly trains ambitious men and women for Poultry Success from start. His famous Home Study System, endorsed by thirty leading Agricultural schools. Fascinating study, easy to learn, complete in every detail, shows valuable success secrets used by leaders, how they avoid losses. How to start in small way. Make business grow from sale of Poultry, Eggs and Baby Chicks. Big, ever increasing demand. Or prepare for a good job in large poultry plant. Established nearly twenty years—a multitude of graduates attest the success of his time-tested methods.

Mr. Lamon has prepared a big 32-page book "How To Raise Poultry for Profit", chock full of money-making poultry facts. He offers to send it Free to anyone interested in learning the splendid money-making opportunities in Poultry Raising. If you are "at sea" on your future, send for this Free Book today.

Address: Harry M. Lamon, President,
NATIONAL POULTRY INSTITUTE
Dept. 51-F Adams Center, N. Y.

FREE BOOK TELLS HOW

A multitude of poultry-raisers large and small are making money in this most interesting and profitable occupation.

Whether you have ever kept chickens or not—whether you have ten hens or ten hundred, you should read this FREE BOOK. It's yours for the asking.



Know Electricity as Experts Know It—and Get an Expert's Pay!

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

The Croft Library of Practical Electricity

The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 50,000 highly paid electrical workers and engineers. Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from estimating it, to completion.

**6 volumes, 2155 pages—New low price
No money down — Easy payments.**

Fill in and mail the coupon attached and we will send you the entire set of six volumes for ten days' Examination on approval. We take all the risk—you assume no obligation. If you decide to keep the books, send \$1.50 in ten days and the balance at the rate of \$3.00 a month. Send the coupon NOW and see the books for yourself.

EXAMINATION COUPON

McGRAW-HILL BOOK CO., 330 W. 42nd St., New York

Send me for ten days' examination on approval the Croft Library of Practical Electricity. If satisfactory I will send you \$1.50 in 10 days and \$3.00 monthly until the price of \$16.50 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name.....
Home Address.....
City and State.....
Position.....
Name of Company.....

PSM 2-40

Offers Aircraft Training At Reduced Tuition Cost

Airplane factories report urgent need of 35,000 trained men immediately. To cooperate with the Government and the Aircraft industry, E. J. Sweeney, president of the Sweeney Aviation Schools, 102B Fairfax Airport, Kansas City, Kan., has arranged four special emergency training courses which students can quickly complete, qualifying them for jobs to help factories catch up on \$400,000,000.00 worth of back-ordered airplanes.

These courses are offered only while the present emergency exists, but are now open to anyone who writes Mr. Sweeney at once.

Apply for "SOUTH AMERICA NEEDS YOU!" Employment

Send for this Fact-Packed Brochure AT ONCE!

Included are 10 "Self-translating" Application Blanks and Mailing List of 125 South American Firms—Everything You Need to Apply for A Job in the Tropics—All for \$1.00

SOUTH AMERICAN FRONTIER ASS'N, 253 Plymouth Bldg., Minneapolis, Minn.



Send for my book how to develop STRONG ARMS and BROAD SHOULDERS

ONLY 25¢

with 20 full pages of illustrations, showing and fully describing exercises that will quickly develop, beautify and make you gain great strength in your Shoulders, Arms, Wrists, Hands and Fingers. Without any apparatus. This is really a remarkable course of Physical Culture exercises. Don't fail to send for it NOW. 25c coin or 30c U. S. Stamps.

Prof. ANTHONY BARKER
1235 Sixth Ave. Dept. P New York City



MECHANICAL DENTISTRY

Short course—personal, individual, instruction—best technical teachers. Profession offers unlimited opportunity—not affected by Machine Age. Most modern and complete methods embracing every branch from plate to porcelain work. Qualifies you to work for dentists or own business. Day or night school. No books—no classes. Catalog upon request.

OR STUDY AT HOME. Write for information on our Home Study Course.
McCARRIE SCHOOL OF MECHANICAL DENTISTRY
207 N. Broad St. Dept. 671 Philadelphia, Pa.

VISIT YOUR DEALER DURING NATIONAL HARDWARE "OPEN HOUSE"

"GOOD
HARDWARE
FOR BETTER
LIVING"

WATCH FOR BIG
INVITATION ANNOUNCE-
MENT IN THE MAY ISSUE OF

POPULAR SCIENCE MONTHLY

POPULAR SCIENCE



APRIL 25
THROUGH
MAY 4



Improved CONNQUEROR

World's largest manufacturer announces sensational improvement in Band Instruments. New patented VO-CABELL revolutionizes tone effects. Easier to play. You'll develop talent fast with these new Conns. Choice of world's greatest artists. See your dealer or write today for FREE BOOK and home trial, easy payment offer. Mention instrument.

C. G. CONN, LTD. 232 CONN BUILDING
ELKHART, INDIANA



CONN

BAND INSTRUMENTS

WRITE
FOR
**FREE
BOOK**



Ryan S-T Kit
No. L1-30 in.-50c

BIG, NEW CATALOG

Shows hundreds of models, including gas models, motors. Send 5c stamps.

BIG wingspans—big values! 16-in. models only 10c—giant 25-in. models, 25c; super-detailed models, working shock-absorbing landing gear and other features, 50c and \$1.00! Every model tested for flyability! Get them at your dealers!

ZIPPER Gas Model

Champion gas model of all time—designed by Carl Goldberg! Outstanding winner in events throughout the country! Climbs 2000 ft. per min.; many amazing new features! 54-in. span—postage 25c, none if ordered from dealer.

\$3.95

What a Climb!



COMET MODEL AIRPLANE & SUPPLY CO.
129 W. 29th St., Chicago, Dept. S-2, 688 Broadway, New York

BIG NEW STREAMLINED LATHE

Swings 10" dia.

**At Sensational
Bargain Price**



Imagine! This extra heavy wood lathe, steel bed 48" long, at low prices. Heavy duty head stock, 4-step cone pulley for V-belt. No. 2 Morse Taper Centers. Sealed ball bearings. 6" face plate screws on to spindle. Tool rest 10" long. Complete line of accessories at amazing low prices. Write today for free catalog describing Blue Star full line precision woodworking machinery. Factory-to-you prices. Not sold through agents. Act at once!

BLUE STAR PRODUCTS

502 Gate Street

Fairfield, Iowa



**BUILD A BOAT BY THE
WELCH SYSTEM.** It's inexpensive; interesting and profitable. Everything for building, equipping or repairing boats. USE **WELCH READY CUT PARTS.** Send 10c for catalog showing boats of many types; boat hardware; propellers; Marine paints; Sails; Boat finishing Materials and **WELCH WHITE CAP MARINE MOTORS.**

WELCH BOAT CO., STATION K-9, MILWAUKEE, WISCONSIN

MYSTERIOUS DEVICE WELDS BRAZES AND SOLDERS



Now, an electric welding, brazing and soldering Torch, complete with power unit, goggles and supplies. **Works INSTANTLY off any light socket.** Does a thousand and one repair jobs at amazingly **LOW COST** on aluminum, iron, steel and other metals. **Indispensable** for Auto, Body and Fender Repairs, and home repairs—shop, factory, farm, engineer, janitor, sheet metal, radio and bicycle repairs. Anyone can handle without previous experience with our simple instructions. **10-DAY HOME TRIAL** Write at once for Special Introductory Low Price Offer. Try 3 in 1 Electric Torch for 10 days at our risk, or get one free by helping to introduce it. **ELECTRO-TORCH CO., 2613-FZ Michigan Ave., Chicago**



JOBS for MEN of ACTION

AIR-CONDITIONING is Booming!

U.S. Industries demand men with combined technical, commercial and practical training.

CHOOSE YOUR OWN PLACE IN

Air Conditioning for Homes, or Commercial Installation and Service, Ventilating, Dairy Refrigeration, Transport Refrigeration, Sales, Research, or Executive Position. **36 YEAR OLD ORGANIZATION** Now receiving applications of men to prepare for good paying positions. No experience needed. We train you under actual working conditions. Every student given individual instruction in immense laboratories on **20th Century Air Conditioned Test Home.** Co-operative Part-time work Plan. Earnest men of high character assisted to earn part expenses. Student loans. Moderate training fees. Few industrial Scholarships awarded to men of outstanding merit. Don't be content with ordinary work and low pay when in a short time you can become a thoroughly trained Specialist in Air Conditioning.

**MILWAUKEE
SCHOOL of ENGINEERING**
Institute of Electrotechnics

GET YOUR FREE COPY
OF NEW BOOK

"Step Up to Success"
Write to

O. Werwath, President

**MILWAUKEE
SCHOOL OF ENGINEERING**
Dept. PS-240
Broadway and East State
Milwaukee, Wis.

Without obligation send free booklet "Step Up to Success." Also tell me how I can become an **Air Conditioning and Refrigeration Specialist in 4 mos. Air Conditioning Engineer (1 yr.)**.....Send details of Student Loan.....Industrial Scholarship....Earn Part Expense....

Name..... Age.....
Address.....
City..... State.....

Be An ARTIST!



LEARN TO DRAW

—at home in your spare time

The fascinating field of Art offers opportunity to both men and women. Trained Artists are capable of earning \$30, \$50, \$75 a week. We train you right at home for a successful career in—

COMMERCIAL ART ILLUSTRATING CARTOONING All in ONE Complete Course!

For 25 years W. S. A. graduates have been "making good" in Art—WHY NOT YOU? No previous Art experience necessary—our instruction is practical and thorough. Write for Booklet—"Art for Pleasure and Profit," fully describes course and **TWO BIG ARTISTS' OUT-FITS** included.

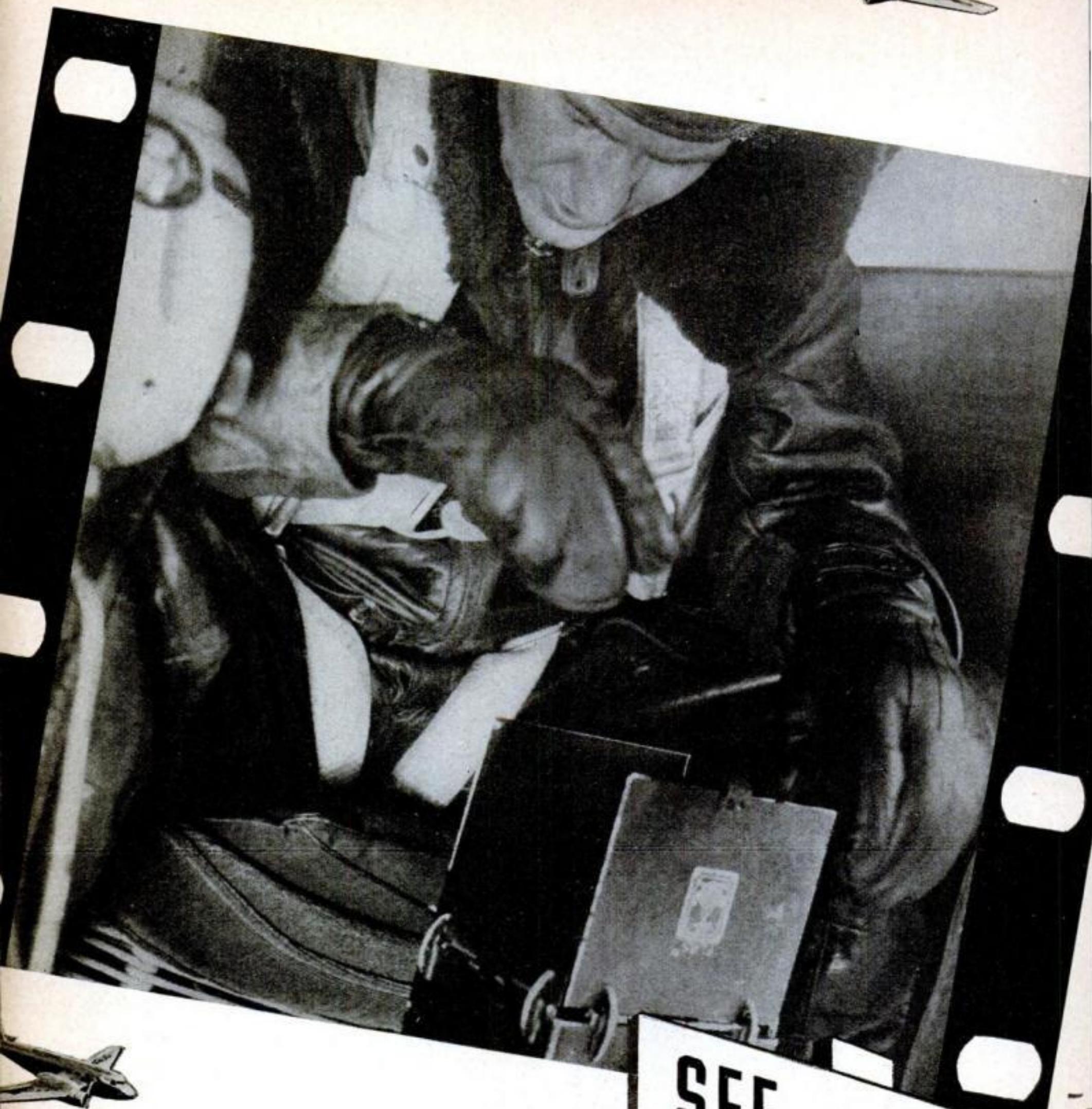
FREE BOOK gives details!

**Washington School of Art, Studio 132P,
1115-15th St., N. W., Washington, D. C.**

Yes! I am interested in learning to draw. Please send me your Free Book, "Art for Pleasure and Profit."

Name..... Age.....
Address.....
City..... State.....

Please mention POPULAR SCIENCE when writing to advertisers.



The making of contour maps from aerial photographs by an amazingly intricate machine is one of the fascinating subjects in the current release of POPULAR SCIENCE-ON-THE-SCREEN. See it in Cinecolor at your local theatre. Produced by Fairbanks and Carlisle with the cooperation of the editors of POPULAR SCIENCE MONTHLY. Distributed by Paramount Pictures.



SEE and HEAR
AERIAL MAP-MAKERS
OF AMERICA in the
latest release of
POPULAR SCIENCE-
ON-THE-SCREEN

Here's my vote to bring the latest release of
POPULAR SCIENCE-ON-THE-SCREEN to my local Theatre

Name of Theatre _____

Address _____

Paste on penny post card and mail today to:

POPULAR SCIENCE MONTHLY, 353 Fourth Ave., N. Y.

DON'T MISS THE
WILY WIZARD OF
WAUKESHA AND
HIS TRIPLE-DECK
SANDWICH MAS-
TICATOR.



READY CUT HOMES

\$416 and up. Freight paid. Save \$500 or more. Buy direct. Modern production methods prevent waste in material and assembly time. 75 home plans to select from, including 10 new feature 1940 designs. All modern, practical, distinctive, complete. Simple plans for easy assembly. Includes all lumber, insulation, roofing, bronze weather stripping, built-in features, attractive one-panel doors, latest hardware, nails, lath, paint, varnish. Also, summer cottages, garages, tourist cabins, etc. Information and plans for FHA Financing requirements on request. For new 1940 full color catalog, with floor plans, send 25 cents to cover mailing. Dept. P.S., 20, International Mill and Timber Co., Bay City, Mich.



NEW COLOR CATALOG FOR ONLY 25¢



NEW Hobby Craft

MAKE YOUR OWN KNICK-KNACKS!



All the knick-knacks you want for home, gifts, or to sell. Articles worth up to \$1.50 and more! Statuettes, wall plaques, busts of famous people. Tie racks, flower pot holders, book ends, many artistic pieces. Made with Hobby-Craft rubber molds, powder, water. Simple, safe. Easy to use. Hours of fascinating fun. Good experience for young and old. SPECIAL OFFER: No. 2 Hobby-Craft Kit, including: 3 molds, large can molding powder, paints, pans, brushes, spoon, and large plaque for mounting casting, only \$1.00 plus postage. Instructive circulars Free!



Complete Kit \$1.00 plus postage
Extra Molds 10c & UP

HOBBY-CRAFT, INC., 341 N. Pulaski Road, Chicago, Ill.



Wonders Through The MICROSCOPE

A new book which tells you all about MICROSCOPY. Turn an inexpensive microscope on hundreds of specimens within a stone's throw of your front door and you step off into a new world of wonders. Complete Manual for amateurs. How to use equipment, secure and preserve specimens, take photomicrographs, etc. Numerous illustrations. Full cloth bound \$1.00.

POPULAR SCIENCE MONTHLY, Dept. 20C
353 Fourth Ave. New York, N. Y.

New Adding Machine Fits Vest Pocket!

Adds, subtracts and multiplies up to one billion. Weighs only 4 ounces. Not a toy—strong guarantee. Absolutely accurate. very fast. Sells to offices, stores, homes—wherever figures are used. Write quick for FREE AGENTS sample offer and Money-Making Plan.

VE-PO-AD, Dept. 208, 303 W. Monroe St., Chicago



NEW SUPER-QUALITY KITSelman FENCE

Heavier, amazingly improved galvanizing. Tougher, longer-lasting Copper-Bearing Steel. Low Factory Prices. WE PAY FREIGHT. Farm, Poultry and Lawn Fence; Steel Posts, Gates, Barb Wire, Electric Fence, Poultry Supplies, Paints, Roofing. Write KITSelman BROTHERS Dept. 138 Muncie, Indiana



FINED FOR IGNORANCE!

Don't Let It Happen to You!



The average grade school graduate earns \$16.30* a week less than high school graduates earn. The average high school graduate earns \$26.26* a week less than do men with college or vocational training.

*Figures computed from Government report. For basis of computation write American School.

College Grade Training Pays up to \$40 a week Extra*

HAVE YOU thought about home study? You look around you at your friends, neighbors and fellow employees: This one earns \$10 a week more than you—that one earns nearly double—a third, though appreciably younger than you, seems to be making better progress. Why? How can you catch up with them? You know that literally thousands of ambitious men and women have won substantial Success through using their spare time at home to master the principles and practice of their chosen lines. HOME STUDY can help you, too, make good.

In 1900, only ONE person in 800 was a high school graduate. Today, one in every 837 is college trained. That's why you need so much more "on the ball" today than ever before. That's why American School has stepped up its complete courses to include so much work of college level. You NEED it, to win out today! Mail coupon right now for FREE information.

Promotion Begins at HOME

Pay raises depend largely on what you do in SPARE time. Make it pay you dividends!

American School, Dept. GG-246, Drexel Ave. at 58th St., Chicago, Ill.

Gentlemen: I'll sit down and consider my Promotion Problems carefully if you will send me FREE information covering special training in subjects checked below. No obligation on my part.

- | | |
|------------------------------------------------------|-------------------------------------------------|
| <input type="checkbox"/> High School Course | <input type="checkbox"/> Diesel Engineering |
| <input type="checkbox"/> Accounting and Auditing | <input type="checkbox"/> Drafting and Design |
| <input type="checkbox"/> Architecture and Building | <input type="checkbox"/> Liberal Arts |
| <input type="checkbox"/> Automotive Engineering | <input type="checkbox"/> Private Secretary |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> Radio and Television |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Elec. and Gas Refrigeration | <input type="checkbox"/> Business Law |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Retail Merchandising |

Name.....
Address.....

Your HAIR

IS IT THINNING OR FALLING OUT?

If your hair is causing you this kind of trouble and it is due to poor blood circulation in the scalp, rent a Crosley XERVAC and try home treatments with this amazing machine. It is designed to help correct just such conditions of the scalp as the lack of proper blood circulation.

Rent a CROSBY XERVAC



Write for free particulars, how you can rent a brand new machine, the same type now used in many barber shops and scalp clinics, for a small rental fee per month, without any obligation to buy. The Crosley XERVAC operates on the principle of alternate vacuum and pressure, known to be effective for forcing fresh, stimulating blood into the deep-rooted blood vessels. Very compact, easy to use. Now that you can rent one you can get its benefits on easiest of terms. Write today for details of this new home rental plan.

THE CROSBY CORPORATION
Dept. B-15 Cincinnati, Ohio

ELECTRICITY

"LEARN BY DOING"
12 weeks training

I'LL FINANCE YOUR TRAINING!

My Big Free Book tells you how we train you in 12 weeks—to start in the growing field of Electricity, by actual shopwork on real electrical machinery—not by books or correspondence. Amazing plan enables many to get training first... then take 10 Months to pay in small monthly payments starting 5 Months from date you start school. Experience or advanced education not needed. Many Earn While Learning. Free lifetime employment service. Diesel Engines, Radio, Electric Refrigeration and Air Conditioning instruction included. MAIL COUPON for FREE BOOK and all Facts.



H. C. LEWIS, President, COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Dept. 20-73, Chicago, Illinois

Send free book with Facts on Coyne, the Pay After Graduation plan, and extra 4 weeks Radio Course now included.

NAME _____ AGE _____
ADDRESS _____
CITY _____ STATE _____

The Man with the Scatter Brain

You know this man as well as you know yourself. His mind nibbles at everything, masters NOTHING. He jumps from one thing to another all the time! Don't be like him! Give yourself a chance. Let me help you to develop your brains. There's a big demand for brains, and they command a good price. Increase your brain-power and you increase your earning power! How? Just let me show you, as I have shown thousands of others!

The first step is to ACT! Don't neglect your future. Begin NOW to improve your brain-power and ability. I will tell you how Pelmanism can help you employ and become skilled in the use of the brain; how to observe with greater accuracy; how to concentrate your attention and arrange your ideas in logical order; how to think and to reason—how to remember!

I repeat, don't neglect yourself! Make your brain more salable! I can help you! Without any obligations whatever, send your name and address to

B. C. McCULLOCH

Desk 72-B Pershing Square Building
NEW ROCHELLE, NEW YORK

WHY CHANGE OIL?

WHEN "OIL DOES NOT WEAR OUT"

(U. S. BUREAU OF STANDARDS)

Car, Truck, Tractor Owners — Stop wasting your money on needless oil changes! Keep oil clean and "oily" indefinitely with "RECLAIMO" the heated super Filter-Refiner. Our Free booklet "Oil Facts" a revelation. Ask your dealer for a copy, or write to—

RECLAIMO MFG. COMPANY
2306 N. WESTERN AVE., DEPT. 25, CHICAGO, ILL.

I'LL TRAIN YOU AT HOME IN SPARE TIME TO MAKE GOOD MONEY IN RADIO AND TELEVISION



Easy to Start Earn While You Learn

You fellows with ambition can make a wonderful success in Radio and Television through my new, practical, home training. You learn easily and quickly by doing interesting experiments with real equipment. Every essential phase of Radio, Television, Electronics, Facsimile, Radio Set Repair and Installation is covered. You get Personalized help. No previous experience needed. My BUSINESS BUILDERS show you how to make profits while learning.

BIG FREE BOOK! Get complete details in new catalog RADIO". Write

Sprayberry Academy of Radio,
355-B University Place, N. W., Washington, D. C.

You Get
146
Radio Parts
•
Radio Tools
•
All Purpose
Analyzer

Learn ADVERTISING at Home

Greater opportunities now in advertising. Learn easily and quickly in spare time. Practical work. No text books. Old established school. Low tuition—Easy terms. Send for free booklet and requirements.
Page-Davis School of Advertising
Dept. 1382, 3601 Mich. Av., Chicago

Do You Want a Fine Farm At a Bargain?

See FARMS, OTHER REAL ESTATE . . Page 55



Earn Cash at Home!

We paid M. M. \$1174 for exceptional "cellar crop" SNOW-KING mushrooms! Big free picture book tells if your cellar, shed, barn suitable. We furnish materials, buy all crops thru our 25 branches. Established 1908. Write today. United Co., 3848 Lincoln Ave., Dept. 339, Chicago.

NEW EXCITING DISPLAYS AT YOUR HARDWARE DEALERS. YOU'RE INVITED TO BROWSE DURING NATIONAL HARDWARE

"OPEN HOUSE"...



**DON'T FORGET THE DATE
APRIL 25 TO
MAY 4**

WATCH FOR THE BIG INVITATION ANNOUNCEMENT IN THE MAY ISSUE OF

POPULAR SCIENCE MONTHLY

SURE ROUTE TO HAPPY-LAND MAIL TODAY SURE

J. C. DEAGAN, Inc., Dept. 4652
1770 Berceau, Chicago

Without cost or obligation, tell me about the easy-to-play DEAGAN MARIMBA... its sensational rise in the music world... the fun it provides at parties... the opportunities for radio, stage and dance-band fame.

EASY TO PLAY

Name—Please PRINT

Address

Please mention POPULAR SCIENCE when writing to advertisers.

\$25.00 A WEEK IN CASE OF SICKNESS OR ACCIDENT

\$25.00 A WEEK : : : : Sickness or Accident
Up to \$5000.00 : : : : Accidental Death
Up to \$5000.00 : : : : Loss of Hands, Feet or Eyes
\$100.00 : : : : Emergency Aid Fund
\$100.00 : : : : Hospital Expense Fund

PLUS ADDITIONAL BENEFITS—ALL AS PROVIDED IN THE POLICY

4000 persons—every hour—day and night—are stricken with sickness and accident. What will happen to you and your family when your turn comes?

ONLY \$1 A MONTH

Write immediately for free inspection of policy.

MEN AND WOMEN AGES 16 TO 75

DON'T SEND A PENNY. NO MEDICAL EXAMINATION. NO AGENT WILL CALL. NO OBLIGATION. SEND YOUR NAME AND ADDRESS AT ONCE FOR 10 DAY FREE INSPECTION OFFER. GEORGE ROGERS CLARK CASUALTY CO. NATIONAL INSURANCE AGENCY Dept. 15, 542 South Dearborn Street, Chicago, Ill.

FREE! WHOLESALE CATALOG

260 pages chock-full of tested fast sellers, for salesmen, dealers and operators. New, Big 1940 issue. Just off the press. Describes many plans for boosting sales, one of which may add \$3 to \$15 a day to your earnings. It illustrates carded goods, automobile accessories, household necessities, office specialties, wearing apparel—over 4500 first quality items at low wholesale prices. Cost about 35c, FREE, while stock lasts. Get your copy by mailing your request for it, now.



4000 BARGAINS

SPORS CO.

12-39 Frank St., Le Center, Minn.

SEVEN WONDERS of the WORLD FREE

Pictured in FULL COLOR—Each 7½ x 10¼". Send only 10¢ to cover mailing costs. The wonders you have longed to see, reconstructed from recent discoveries and painted by famous artists, so you can view them at the height of their glory and read their stories. 24 page booklet. Educational! Entertaining! Mail 10¢ to

WM. H. WISE & CO., Dept. 802, 50 West 47th Street, New York City.

GOVERNMENT JOBS

MEN—WOMEN

Get ready now for Lifetime Jobs

Salaries \$1,700-\$2,100 Year



So sure are we that our simplified Interstate Home Study Course of coaching will result in your passing the examination and being appointed that we are willing to accept enrollments on the following basis: The price of our complete 10 week course is \$30. . . .

BUT YOU DON'T

Pay for Course Until After You Are Appointed and Working

Clip and Mail This Coupon NOW!

INTERSTATE HOME STUDY BUREAU
 901 BROAD ST., DIV. PS-240, NEWARK, N. J.

PS-240

Please send me full particulars without any obligation of how to qualify for a government job.

NAME _____ Please Print Plainly in Pencil

ADDRESS _____

CITY _____ STATE _____

NEW DE LUXE ZEPHYR COMPLETES CORONA LINE



De Luxe Zephyr \$39.75

Regular Zephyr \$29.75

CORONA SPEEDLINE

3 models

\$49.50 and up

(prices subject to revision)

CORONA PORTABLES

Now five models to choose from, each "tops" in its price class...each bearing the "best known, best liked" name in portables. Write for booklet.

L C SMITH & CORONA TYPEWRITERS INC

Desk 2, 721 E. Washington Street, Syracuse, New York

Please send me free folder describing Speedline Coronas.

Name _____

Address _____

City _____ State _____

Learn this Profitable Profession



in 90 Days at Home

Hundreds of men and women of all ages 18-50 make \$10.00 to \$20.00 in a single day giving scientific Swedish Massage and Hydro-Therapy treatments. There is a big demand from Hospitals, Sanitariums, Clubs, Doctors and private patients as well as opportunities for establishing your own office.

Learn this interesting money-making profession in your own home by mail, through our home study course. Same instructors as in our NATIONALLY KNOWN resident school. A diploma is awarded upon completion of the course. Course can be completed in 3 to 4 months. High School training is not necessary. Many earn big money while learning.



Anatomy Charts & Booklet FREE

Enroll now and we will include uniform coat, medical dictionary, patented reducing roller and Hydro-Therapy supplies without extra cost. The reducing course alone may be worth many times the modest tuition fee.

Send coupon now for Anatomy Charts and booklet containing photographs and letters from successful graduates. These will all be sent postpaid—FREE.

THE College of Swedish Massage (Successor to National College of Massage)
 Dept. 270, 30 E. Adams St., Chicago.

You may send me FREE and postpaid, Anatomy Charts, booklet containing photographs and letters from graduates, and complete details of your offer.

Name _____

Address _____

City _____ State _____

POPULAR SCIENCE Books -

**THE
MOST PRACTICAL,
EASY-TO-FOLLOW
MANUALS EVER
PUBLISHED**

THESE practical, easy-to-understand handbooks will help you get the most out of your hobby. Written by experts especially for Popular Science Monthly readers, they are invaluable to the mechanically minded man. Each book is fully illustrated, with pictures and diagrams. Bound in sturdy library cloth. You need not hesitate to order them for yourself or for gifts. We guarantee complete satisfaction or money back.

MAKING MONEY WITH YOUR CAMERA

Here is an exceptionally practical manual that will teach you many kinks and tricks, ways and means to take and sell pictures. It clearly demonstrates by pictures and directions the principles of picture taking that brings you photos which are marketable—and how and where to sell them. COMPLETE, FASCINATING, EASY TO UNDERSTAND. 256 pages, full cloth bound, \$2.00.

RADIO BEGINNERS SIMPLIFIED MANUAL

Every radio operation from trouble shooting, to building and improving marvelous long and short wave sets, is made so simple and clear that you just cannot fail to understand many things that may have puzzled you before. A few minutes a day with this manual will teach you what it takes years to learn without it. Prepared by technical radio experts who KNOW how to explain things for non-technical radio enthusiasts. Cloth bound, 256 pages, hundreds of simplified drawings and diagrams, \$2.00.

MODEL RAILWAYS

A practical handbook that shows how to lay out and operate a home-made model railroad. Easy-to-follow instructions for building a box car, gondola, refrigerator, tank, hopper, day-coach, pullman, baggage, observation car, and Atlantic type locomotive. How to turn out fireboxes, boilers, and wheels in your own shop. How to make an illuminated dispatcher's track diagram. How to build and install a block signal system, remote train control, automatic couplers, relays, etc. 256 pages, fully illustrated, full cloth bound, \$2.00.

DECORATIVE METAL WORK

Simplified for Beginners

A brand new manual that tells in easy-to-understand language how to make useful metal articles in your home workshop with simple tools. How to do inlaying, spinning, cutting, etching, joining, plating and finishing. How to make jewelry, novelties, candle sticks, ash trays, lamps, hardware, and other useful metal articles. Full cloth bound, fully illustrated, \$2.00.

ELECTROPLATING

Written especially for the amateur, this book tells you how to utilize many odds and ends to build a complete home electro-plating workshop. Instructions, pictures, and diagrams show how easily you can do copper, nickel, chromium, silver and gold plating. How you can plate household or automobile fixtures, hardware, tools, silverware, ornaments, clocks, watches, bracelets, rings, metal parts of all kinds. Scores of illustrations, diagrams, and pictures. 260 pages, full cloth bound, \$2.00.

WOOD CARVING and WHITTLING

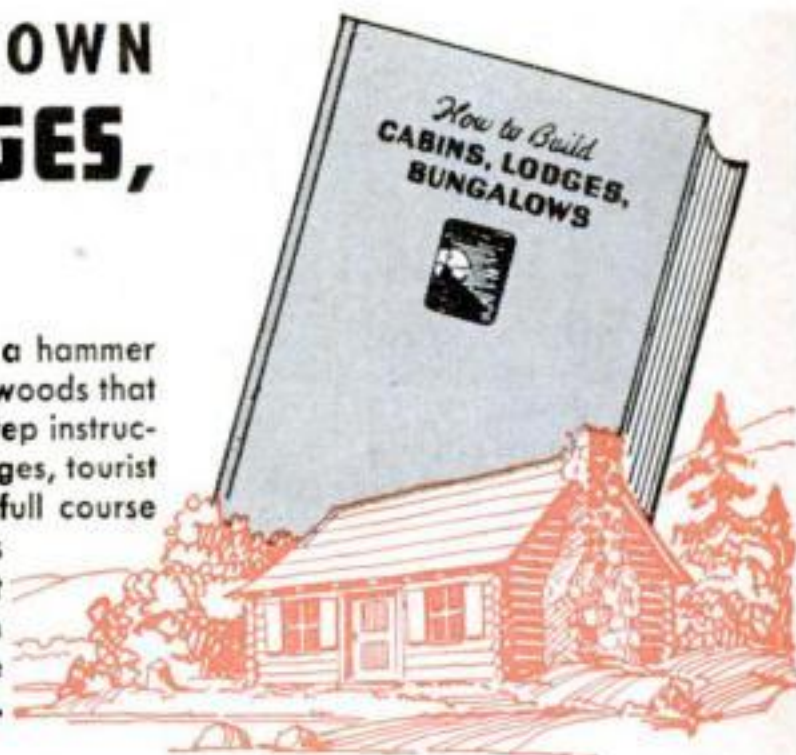
An Artistic and Interesting Hobby for All

This new practical handbook starts with the simplest kinds of wood carving and shows you step-by-step, how to become expert. How to carve figures of men, animals, birds, with simple hand-tools. Chip carving, incising, level surface carving, relief carving explained. How to carve furniture, ornaments, frames, jewelry boxes, trays, treasure chests, etc. Fully illustrated, 265 pages, full cloth bound, \$2.00.

for Men who *LIKE* to *DO THINGS*

NOW IT'S EASY TO BUILD YOUR OWN HUNTING and FISHING LODGES, CABINS, BUNGALOWS

A big book of definite instructions for beginners. If you can handle a hammer and saw, there's no reason why you can't build a bang-up cabin in the woods that anyone would be glad to live in, or own. Complete plans, and step-by-step instructions for every stage of the work. Designs for numerous log cabins, lodges, tourist homes, wayside stands, bungalows. Not just a book of pictures but a full course of instruction. Every problem of location, drainage, water supply, etc. is clearly explained. Tells how to cut and erect your structure — all about floors, roofs, windows, doors — how to do the whole job from foundation to chimney top. Don't imagine it's hard—when you see the book you'll be aching to grab some tools and get to work. 256 pps., full cloth bound, \$2.00.



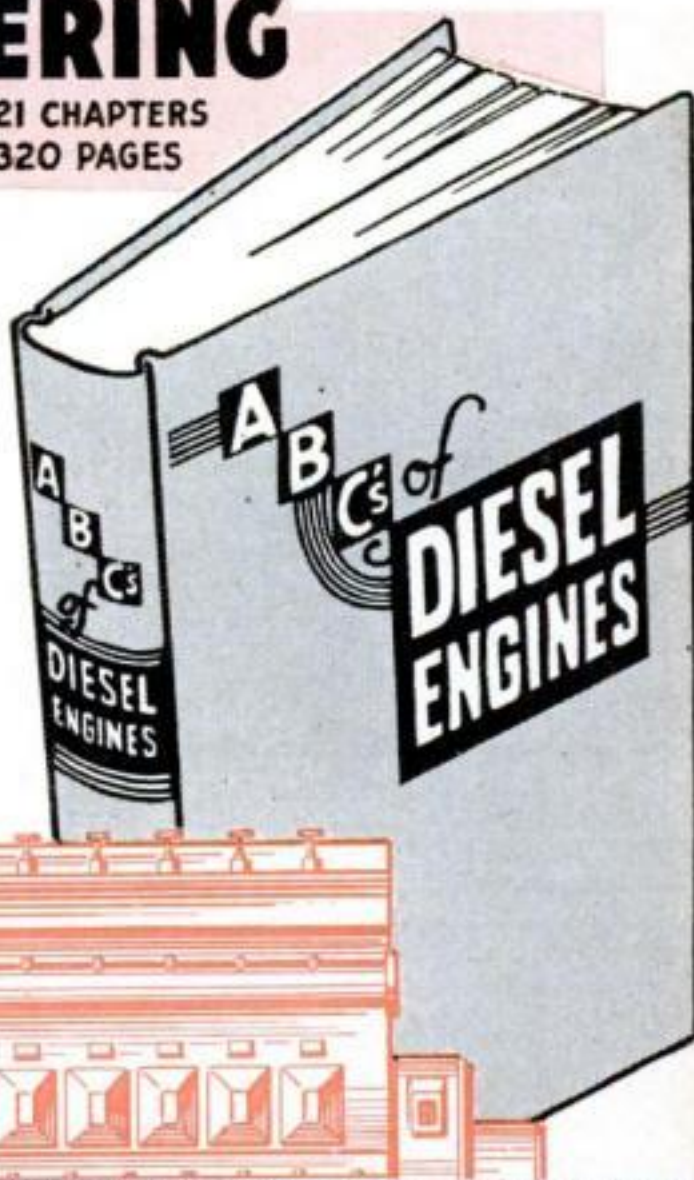
LEARN DIESEL ENGINEERING WITH THIS NEW SIMPLIFIED MANUAL

21 CHAPTERS
320 PAGES

Here at last is a book written for the man who has had no previous knowledge of Diesel Engines. Takes you in easy-to-grasp stages right from the fundamental principles of the Diesel to the most modern advanced types of engines. Tells you in clear, non-technical language just how and why the Diesel operates — what happens in the cylinders. All about pressure, volume, speed, and heat. Various fuels and how they are rated. Different types of Diesels, and their comparative economies — air and other types of starters, etc. Adapting the Diesel to automobiles, ships, trains, and airplanes. How you can take advantage of the many opportunities that Diesel Engineering offers.

THE A B C'S OF DIESEL ENGINES is profusely illustrated from beginning to end, including useful tables, reference data, operating costs, and other information invaluable to the Diesel-minded man. You can **DEPEND** upon the completeness and accuracy of this great book.

Full cloth bound, \$3.00



**SEND NO
MONEY NOW!
TEAR OFF AND MAIL
THIS COUPON TODAY**

POPULAR SCIENCE, DEPT. 20B, 353 FOURTH AVENUE, NEW YORK, N. Y.

Please send me the book or books I have circled below. I will pay the postman the price shown plus a few cents postage in full payment when the books are delivered. (Money back if not satisfied.)

Camera	\$2.00	Radio Experimenter...	\$2.00	Cabins ..	\$2.00
Wood Carving...	\$2.00	Metal Work	\$2.00	Diesels ..	\$3.00
Electroplating ...	\$2.00	Model Railways	\$2.00		

NAME _____

ADDRESS _____

CITY _____

STATE _____

If you remit now we pay postage.

Orders from outside U. S. A. cannot be sent C. O. D.

LIVE DANGEROUSLY

--- said Nietzsche, Philosopher



Learn To Wrest The Utmost From Life!

DON'T HOLD BACK—life is yours to live and enjoy each conscious moment. Not in a sheltered, routine living, but only in a tempest of life's forces—which challenges every element of your nature—will you receive that inspiration, those ideas, which will bring you personal supremacy and happiness. *Live boldly but knowingly*—learn to utilize nature's laws to the fullest extent.

A FREE Book of Facts

Let the Rosicrucians (not a religious organization) show you how to direct *little-known* laws of life and mind—used by the sages for centuries. Write for the free book, "The Secret Heritage" today. Address Scribe: A.U.M.

The ROSICRUCIANS (A.M.O.R.C.)
San Jose, California, U. S. A.

NEW TYPE CHEAP OIL BURNER

Sweeping the Country!!

COOK and HEAT Without Coal or Wood

In Your Present Stove or Furnace—
HOTTER—No Drudgery.
Dirt or Ashes—More Heat
Quick at **SMALL COST.**

OVER 40,000 SOLD

Beats any cheap burner ever gotten out for low cost, perfect performance. Burns cheap oil a new way, without pre-generating or clogging up. Quick intense heat by Simple Turn of Valve. **GUARANTEED.**

30 DAYS' TRIAL

Prove its efficiency, convenience and economical operation.

**Write Immediately for
FREE BURNER
OFFER TO AGENTS**

who will demonstrate and take orders. Write quick, be first to learn how to make **REAL MONEY** right now, spare or full time—mail 1c postcard today.

UNITED FACTORIES, B-761, Factory Bldg., Kansas City, Mo.

AGENTS Salesmen BIG MONEY

F. Silvers says: "I can dispose of 250 **HEAT KINGS** before this year ends." Sample Burner **FREE** to producers. Write us now for agents' offer.



Slips Into
Any STOVE
RANGE or
FURNACE

**Quick HEAT at
Turn of Valve!**

Please mention **POPULAR SCIENCE** when writing to advertisers.

FACTORY-TO-YOU SAVES YOU UP TO 50%

**EASY
TERMS**



**30
DAYS
TRIAL**

**TELEVISION
ADAPTATION
SUPER BUILT-IN
AERIAL SYSTEM**

GET WAR NEWS DIRECT!

... with this amazing new radio-phonograph chassis combination—or, play records on new-type electric phonograph. Other radio models from 5 to 17 tubes, and up to 5 wave bands. Offered on 30-day **FREE** trial. Send 1c post card for **FREE** catalog showing complete line. (User agents make extra money.)



See Midwest's Answer
to **TRADE-INS!**

14 TUBE
RADIO CABINET MODEL
\$29.95
COMPLETE

**PUT THIS NEW
14 TUBE
RADIO-PHONO
CHASSIS IN
YOUR PRESENT
CABINET**

**Only
\$22.50**
COMPLETE

MIDWEST RADIO CORPORATION
DEPT. 59-J CINCINNATI, OHIO

Learn to MOUNT BIRDS

Tan SKINS, Make Up FURS

Be a Taxidermist. We teach you at Home.

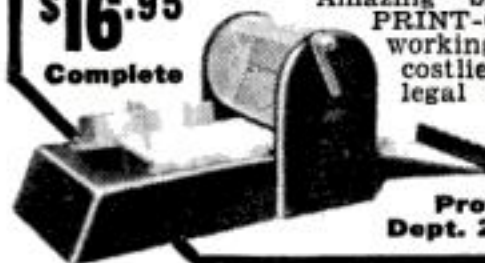
Mount **Birds, Animals, Pets**, common specimens. Save your hunting trophies; decorate home and den. Make genuine **KROME LEATHER**, tan and make up furs for sparetime profit.

FREE BOOK 48 pages—tells all about it. Hunters, get this wonderful book. Its Now Free. Send postal card Today—This Minute! State your AGE.

N. W. School of Taxidermy, Dept. 339-2, Omaha, Nebr.

NEWEST TYPELESS PRINTER

\$16.95
Complete



Amazing brand new, heavier model **PRINT-O-PRESS**, with smoother working features. Compares with costliest stencil duplicators. Full legal size. Also other models at equally low prices. **FREE** Details and Samples of work. User-Agents Write.

Professional Products Corp.
Dept. 256, Silverton, Cincinnati, O.

DECORATIVE METAL WORK

A new manual for the amateur. Tells in easy to understand language how to make useful metal articles in your home workshop. You'll be surprised how easy and interesting metal work really is. **Fully illustrated** with diagrams and step-by-step instructions. Sturdy cloth binding, 253 pages. Send only \$2.00 and your copy will be sent postpaid.

POPULAR SCIENCE MONTHLY—Dept. 10
353-4th Ave. New York, N. Y.

Be an OPTICIAN

**STUDY
AT
HOME**

Learn this well paying uncrowded profession. Many make \$35.00 \$40.00 \$50.00 a week making eyeglasses.—Great Demand! Over 70% of population need or wear eyeglasses.—Successful optical stores everywhere earn from \$5,000.00 to \$10,000.00 per year.—Dignified profession.—Has Sanction and co-operation of the Medical Profession.

Spare time study does it all! No interference with your present work. —Open to men and women of all ages.—Low cost, easy terms.—Degree conferred by chartered college. Write for Free Bulletin.

ILLINOIS COLLEGE OF MECHANICAL OPTICS
Dept. 1260, 30 N. Dearborn St., Chicago, Illinois

\$200 My First Week



... Now in
my **OWN**
Business.

Would you, too, like to own a business where you could take in \$200 your first week as did L. A. Eagles in Madison, Wisconsin?

We want a reputable, honest man in each county. This man need not have any special experience or more than ordinary ability, but he must be honest and courteous.

Such a man we will start in business for himself. You can make far above average profits in the rug-washing business—a high-grade business all your own. Many earn \$125 to \$200 per week—some considerably more.

NO SHOP NECESSARY

The rug-washer finishes rugs like new on the customer's floor. Anyone can run it. Electricity does the work. A quick, thorough and highly-efficient method that restores the natural beauty of floor coverings.

There are hundreds of customers—in your vicinity and nearby towns. The business grows steadily. Simply wash a few rugs or carpets. These customers tell others and also give you their future work. Soon you will have a prosperous year-around business. Send coupon for booklet explaining everything.

"Profits Pay for Home"

Harry Hill built and paid for a home from rug-washer profits. His first day's business was \$86. Another man writes, "Made \$70 in 13 hours." A. L. Miller says, "Have had rug-washer 6 years—have earned as high as \$92 a day." M. O. Malmin earned 3 times the cost of his machine the first two months. You, too, can enjoy a large income.

VON SCHRADER MFG. CO., 362 PL., RACINE, WIS.

Free Book!
MAIL COUPON now

VON SCHRADER MFG. CO.
362 Pl., Racine, Wis.

Send at once (no obligation) your free booklet illustrating rug-washer and telling how I can own my own permanent business; how I can earn large profits at prices below other methods; how I can become financially independent in a short time; and how I can pay on easy terms.

Name.....

Address.....

City..... State.....

"Never a Complaint"

C. J. White says: "\$100 business in six days—never a complaint." That is the nicest part of this business—every customer is more than satisfied. Stains and blotches disappear and vivid colorings and freshness in faded floor coverings come back.

EVERY MACHINE GUARANTEED

You take no risk. These machines have been manufactured since 1918 and are used by the United States Government and by many of the world's largest hotels. They are fully GUARANTEED.

EASY TERMS

The complete equipment is inexpensive. A reasonable down payment brings everything to you and the balance is paid monthly. From the start, you have your own business—one that is profitable and of which you can be proud.

**MAIL
COUPON
Today**



LEARN WELDING

Both Electric Arc and Acetylene by practical Shop-Plan method in a few short weeks. No text-books. You learn by doing. Finest equipment. Low tuition. Pay-After-Graduation-Plan. Also, courses in Auto Mechanics, Collision Work, Metal Finishing, etc. Illustrated literature free. Write today.

MICHIGAN TRADE SCHOOL
3716 Woodward, Detroit, Mich.

**Write for
FREE
FOLDER**

AN AVIATION CAREER



OFFERS YOU GREAT FUTURE!

Demand for trained aircraftmen is increasing and already exceeds supply. Curtiss-Wright Tech, Aviation's foremost school, is located on Grand Central Air Terminal in heart of the aircraft industry and specializes in training MASTER MECHANICS and AERONAUTICAL ENGINEERS. (No flying involved.) Graduates are obtaining immediate employment. Write for details NOW. Dept. PS-2

Curtiss-Wright Technical Institute, Glendale (Los Angeles) California

GET A GOVERNMENT JOB



**RAILWAY
POSTAL
CLERKS**

City and Rural Carriers—Postoffice Clerks—
File Clerks—Accountants—Stenographers—
Typists—Many other Government Jobs.
Common Education Usually Sufficient

\$1260 to \$2100 First Year

Mail Coupon Before You Lose It

FRANKLIN INSTITUTE, Dept. W-251, Rochester, N. Y.

Sirs: Rush to me, without charge, copy of 32-page book, "How to get a U. S. Government Job," list of positions, and full particulars telling how to qualify for them.

Name.....

Address.....

Learn by pre-tested Training

RADIO *plus* TELEVISION



A flexible Training Plan to fit your immediate needs

National Schools offer optional training planned to fit your present circumstances. You can master Radio, Television, Sound and allied trades by National's exclusive plan. Actual shop and studio training; also complete training if you cannot give up your present employment and income. A definite plan to fit your needs.

FREE LITERATURE

Explains National's pre-tested plan; how you can master Radio, all branches, Sound-Recording, Public Address & Communication Systems, Broadcasting, Television. This interesting literature sent post-paid, without obligation to you.

NATIONAL SCHOOLS
Los Angeles (EST. 1905)

Request for **FULL DETAILS**

NATIONAL SCHOOLS, Dept. PSR-2
4000 S. Figueroa St., Los Angeles, Calif.

NAME _____ Age _____

ADDRESS _____

CITY _____ STATE _____

Regain Perfect Speech, if you

STAMMER

Every stammerer should have the new 287 page book "Stammering, Its Cause and Correction". Sent free to stammerers. It describes the Bogue Unit Method for the scientific correction of stammering and stuttering. Method successfully used at Bogue Institute for 39 years—since 1901. Endorsed by physicians. Write for full information. No obligation.

Benjamin N. Bogue, Dept. 960, Circle Tower, Indianapolis, Indiana.

PINS 30¢ RINGS \$1.50 up

Finest quality. Over 300 artistic designs. Write for our attractive free catalog and select a beautiful pin or ring for your class or club.

Dept. O, METAL ARTS CO., Inc., Rochester, N. Y.

FREE CATALOG

**Be a
McNess Man**

**No Time Like
Now to Get in..**
Make up to \$75 a week

It's no trick to make up to \$12 a day when you use your car as a McNess "Store on Wheels."

Farmers are buying everything they can from McNess men. Attractive business-getting prizes, also money-saving deals to customers make selling McNess daily necessities a snap. This business is depression-proof.

We Supply Capital—Start Now!

There's no better work anywhere—pays well, permanent, need no experience to start and we supply capital to help you get started quick. You start making money first day. Write at once for McNess Dealer Book—tells all—no obligation. (92-B)

THE McNESS CO., 867 Adams St., Freeport, Ill.



**Use Your
CAR
to Raise
Your
PAY**



**TIRE PUNCTURED
27 TIMES..**

**LEAKS
NO AIR**

**1001 Repairs In Home,
Auto, Farm For Only**

New plastinoid "putty"—**SO-LO**—fills cracks, holes in tires, shoes, boots—anything of rubber, leather or cloth. Spreads on like butter. Dries tough. Waterproof, flexible, non-skid. Won't come off—guaranteed! 25c package (25 repairs) shows many uses. At any 10c or hardware store.

**1c
EACH**



So-Lo

"Woolworth, Kresge, Newberry, Murphy, McCrory, Nelsner, McLellan, Sears and Ward, are now featuring SO-LO".



**NEW
TURN SIGNAL**

FLASHES from REAR WINDOW—DASH Control

AGENTS A whirlwind seller. Drivers buy on flash demonstration. Dealers buy 3 to 12. Your profit mark-up as high as 264%. Biggest sensation of year. Rush name quick for facts and Demonstrator sample plan. All Free! Rush.

WATCH-MY-TURN SIGNAL CO., Dept. W132 Walnut Bldg., Des Moines, Iowa

AVIATION APPRENTICES

AIRMINDED YOUNG MEN INTERESTED IN TRAINING FOR ENTERING THE WELL PAID FIELD OF AVIATION AS APPRENTICES—Write immediately, enclosing stamp. MECHANIX UNIVERSAL AVIATION SERVICE CO. Wayne County Airport Box 857 Dept. H Detroit, Michigan



How to Win Fortune, Happiness by a Book

Money not essential to begin business or develop a winner. Too much money, unless earned by experience, usually means failure. Success develops itself. Marconi, Carnegie, automobile, telephone, telegraph, camera all started from **BOOKS**. Read **HOW**. Learn to get ahead in sure, inexpensive way. For free **HOW GUIDE**, write your name and address on postcard, mail today to

R. & R. Co., 611 H. St., Melrose, Massachusetts

RADIO ENGINEERING, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. 48 weeks' engineering course equivalent to three years' college radio work. School established 1874. All expenses low. Catalog free.
Dodge's Institute, Nye St., Valparaiso, Ind.

BE A PASSENGER TRAFFIC INSPECTOR



Railway and Bus
Get Free Booklet describing our 21 yrs.' service placing Men (19-50) in jobs paying up to \$135 per mo. to start. Simple home-study course trains you in spare time. Standard Business Training Institute, Div. 322, Buffalo, N. Y.

Get into the BAKING BUSINESS

Bakers make good money! Now 7th Industry in wages! Nearly depression-proof. New home study Baking Course qualifies you. Common school education sufficient. If you're ambitious, write for **FREE BOOK**, "Opportunities in Baking." **National Baking Institute, 3601 Michigan, Dept. 1362, Chicago**



**Do You Want to Save On
Auto Parts and Supplies?**

See **AUTOMOBILES** Page 53
AUTO PARTS & EQUIPMENT Page 53
and **ENGINES & MOTORS** Page 55

PARKS AIR COLLEGE

PARKS AIRPORT EAST ST. LOUIS, ILL.

Offers YOU COLLEGE and PROFESSIONAL TRAINING Majoring in AVIATION

Accredited by the Illinois Superintendent of Public Instruction, U.S. approved as a Commercial Ground and Flying School and Mechanics' School. Accredited by and cooperating with the United States Army Air Corps in giving flight and mechanical training. Open to high school graduates.

FOUR courses lead to B.S. degrees in Professional Piloting, Aviation Operations, Maintenance Engineering, Aeronautical Engineering. SEVENTEEN TRAINING PLANES are used in professional flight training which prepares graduates for airline flight operations. 74% of graduates enter air transportation in North and South America. 76,000 hours flight training given. 1800 hours being flown monthly. FACULTY of 48 specialists in various fields of aviation. 1569 graduates. Enrollment limited to a total of 300 commercial aviation students. Total enrollment 415. 100-acre airport, 18 buildings devoted to school purposes exclusively. Dormitories and dining hall at the College.

Spring Term April 1. Send postcard for new 64-page catalog.

13th YEAR Registrar, Dept. PS-2
PARKS AIR COLLEGE, East St. Louis, Ill.

Learn Photography at HOME

Splendid opportunities. Prepare quickly in spare time. Easy method. No previous experience necessary, common school education sufficient. Many earn while learning. Send for free booklet "Opportunities in Modern Photography", particulars and requirements.

AMERICAN SCHOOL OF PHOTOGRAPHY
3601 Michigan Avenue Dept. 1362 Chicago, Illinois

CARTOON YOUR WAY TO SUCCESS!

DON'T COPY - LEARN TO ORIGINATE!
RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you can SELL! Course has 26 lessons and 600 illustrations. \$2.85
Send name and address for free details. Only....

RAYE BURNS SCHOOL, Dept. S-8, Box 2194, CLEVELAND, O.

ENGINEERING DEGREE IN TWO YEARS

B. S. Degree courses in engineering: Electrical, Civil, Chem., Mechanical, Radio or Aeronautical. 1 yr. Mech. Drafting. Approved by Civil Aeronautics Authority, participation in Pilot Training Program. Large industrial center. Prep courses without extra charge. Earn board if desired. Low tuition. Enter March, June, September, December. Write for Catalog.

620 E. Washington Blvd., Fort Wayne, Ind.

INDIANA TECHNICAL COLLEGE

EARN A DEGREE AT HOME

From A Chartered Institution of Higher Learning
Employers Now Demand College Graduates With Degrees

28 Degree Courses in Arts; Sciences; Philosophy; Education; Public Health; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business; Training; Accounting; Statistics; Adv.; Agriculture; Sales; Electrical; Civil, Mechanical, Drafting, Architectural, Automotive, Steam, Diesel, Aeronautical, Radio, Structural, Industrial, Highway, Petroleum, Mining, Marine, Refrigeration, Air Conditioning, Chemical Engineering. Founded 1908. Chartered.
McKinley-Roosevelt Graduate College, 4750-A Sheridan Road, Chicago

FREE! JUST OUT! AMERICA'S MOST BEAUTIFUL Nursery and Seed BOOK

FIRST QUALITY GUARANTEED STOCK FROM AMERICA'S LARGEST Direct-To-You Nurseries. Plan your garden right from this helpful new book of choicest flowers, fruits, seeds, shrubs, roses, etc. Free gift offers and planting guide for customers. Low prices. Write to-day.
INTER-STATE NURSERIES, 3820 E. Street, HAMBURG, IOWA

52 FEMALE \$2.50 MALE \$1.50
CASH PAID Why not get ready now to spend spring, summer, fall, outdoors gathering insects—butterflies, moths. I buy hundreds of kinds for collections. Good cash prices paid. Some \$1 to \$7 each. Easy. Simple. Send 10¢ not stamps for Illustrated Prospectus before sending any insects. Write today! HURRY!
MR. SINCLAIR, DEALER IN INSECTS
Dept. 7, Box 1830 San Diego, Calif.

BARGAINS!!! Used Home-Study Courses BOUGHT-SOLD-RENTED

72-PAGE ILLUSTRATED CATALOG FREE

Write today for big FREE illustrated catalog explaining this amazing service. Used correspondence courses and educational books on every subject. 100% satisfaction guaranteed. We buy for cash—we offer unbelievable bargains. Send your name on penny postcard at once! No obligation.

NELSON CO.
B-201 Manhattan Bldg. Chicago



FOOD IN BOTH HANDS!

LUNCH BOX in one hand, I.C.S. textbook in the other—all over this country today there are men who will devote those extra moments at the lunch hour to learning something that will help them on their present jobs—something that will help them prepare for the bigger, better paying jobs up the ladder. International Schools offer training courses prepared by experts, and taught by instructors who are personal counselors to their students. This evening over 100,000 ambitious men will absorb benefits from this forty-eight-year-old educational institution.

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 7677-J. SCRANTON, PENNA.

Explain fully about your course marked X:

TECHNICAL AND INDUSTRIAL COURSES

- | | | |
|-------------------------------------------------|---------------------------------------------------|--------------------------------------------------------|
| <input type="checkbox"/> Agriculture | <input type="checkbox"/> Air Brake | <input type="checkbox"/> Managing Men at Work |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Manufacture of Pulp and Paper |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Auto Engine Tune-up | <input type="checkbox"/> Marine Engines |
| <input type="checkbox"/> Auto Technician | <input type="checkbox"/> Aviation | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Navigation |
| <input type="checkbox"/> Building Estimating | <input type="checkbox"/> Chemistry | <input type="checkbox"/> Patternmaking |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> Coal Mining | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Concrete Engineering | <input type="checkbox"/> Contracting and Building | <input type="checkbox"/> Plumbing |
| <input type="checkbox"/> Cotton Manufacturing | <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Practical Telephony |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Poultry Farming |
| <input type="checkbox"/> Foundry Practice | <input type="checkbox"/> Fruit Growing | <input type="checkbox"/> Public Works Engineering |
| <input type="checkbox"/> Heating | <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Radio Operating |
| <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Radio Servicing |
| <input type="checkbox"/> Machinist | <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> R. R. Section Foreman |
| | | <input type="checkbox"/> R. R. Signalmen |
| | | <input type="checkbox"/> Refrigeration |
| | | <input type="checkbox"/> Sheet Metal Work |
| | | <input type="checkbox"/> Steam Electric |
| | | <input type="checkbox"/> Steam Engines |
| | | <input type="checkbox"/> Structural Drafting |
| | | <input type="checkbox"/> Structural Engineering |
| | | <input type="checkbox"/> Surveying and Mapping |
| | | <input type="checkbox"/> Telegraph Engineering |
| | | <input type="checkbox"/> Textile Designing |
| | | <input type="checkbox"/> Welding, Electric and Gas |

BUSINESS COURSES

- | | | |
|--------------------------------------------------|----------------------------------------------|---------------------------------------------------|
| <input type="checkbox"/> Advertising | <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Grade School |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Business Management | <input type="checkbox"/> High School |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> Civil Service | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> College | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Lettering Show Cards |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Commercial | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> Foremanship | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> French | | <input type="checkbox"/> Secretarial |
| | | <input type="checkbox"/> Service Station Salesman |
| | | <input type="checkbox"/> Sign Lettering |
| | | <input type="checkbox"/> Spanish |

DOMESTIC SCIENCE COURSES

- | | |
|-----------------------------------------------|----------------------------------------------------------------------|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Professional Dressmaking and Designing |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Home Dressmaking | |

Name..... Age.....

Address.....

City..... State.....

Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

Please mention POPULAR SCIENCE when writing to advertisers.

POPULAR SCIENCE



Classified

OPPORTUNITIES

**MONEY-MAKING,
MONEY-SAVING**

FOR FEBRUARY

Do You Want to Get Into Business for Yourself?

See **BUSINESS OPPORTUNITIES** **Page 53**
and **MONEY MAKING OPPORTUNITIES** **Page 56**

Do You Want to Save Money on Cameras?

See **CAMERAS, PHOTO SUPPLIES** **Page 54**

Are You Looking for a Red-Hot Item to Sell?

See **AGENTS WANTED** **Page 52**
and **HIGHGRADE SALESMEN** **Page 55**

Do You Want Some Real Bargains in Rare Stamps?

See **STAMP COLLECTING** **Page 58**

ADVERTISING

MAIL-ORDER or agent ad reaching 1,500,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, ratebook, free. Chicago Advertising Agency, 20-SP West Jackson, Chicago.

LEARN Advertising at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue, Dept. 1742, Chicago.

ADVERTISE: 24 words, 149 newspapers \$6.50. Lists free. Advertising Bureau, 4515-P Cottage Grove, Chicago.

ADVERTISE: newspapers, magazines, periodicals, lists free. Fidelity Advertisers, 3838-K Washington, Chicago.

AGENTS WANTED

IS your job a "blind alley?" There's a real future in your own wholesale business. Profits can run into really big money. Start with little as \$2.50. Handle steady year 'round route of local stores. Collect, deliver orders for 200 nationally advertised 5c-10c counter products. Use home as headquarters. Chance to operate one of our Silver Fleet Service trucks. No experience necessary. Facts Free. World's Products Co., Dept. 83-P, Spencer, Ind.

DON'T be a job hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary. Wonderful opportunity to own pleasant, dignified, profitable business backed by world-wide industry. Write Rawleigh's, Dept. B-U-PSC, Freeport, Ill.

GIFTS for Housewives. Cash income for you. Make real profits on easy-to-get daily orders for groceries, 200 other necessities. Amazing variety of premium gifts. Hand out with every order. Full, spare time. Big display products, premiums, samples furnished qualified dealers. Togstad Co., Dept. M-17, Kokomo, Ind.

WRITE quick for amazing new line of men's shirts and sport ensembles. Easiest sellers. Low as 3 for \$2.98. Beautiful Sanforized fabrics, exclusive features. Money back guarantee. Big profits assured, repeat business. Valuable outfit Free. Stylewear, Dept. A-107, Erie, Pa.

YOUR hose free with outfit. Make up to \$32.50 in a week taking orders for amazing new hosiery. Replacement guaranteed against holes, snags, runs. Rush name, hose size. Wilknit, Desk BB-80, Greenfield, Ohio.

LOCAL Agents wanted to earn bonus suits and demonstrate to friends. Up to \$12 in a day easy. Experience unnecessary. Valuable demonstrating equipment, actual samples absolutely Free. Progress Tailoring, Dept. C-221, 500 Throop, Chicago.

\$3,000 PROFIT in six months by Foster. Over \$6,000 in one year by Felton. Over \$30.00 daily for 90 days by D.F.F. All selling our special tool set to garages. Exclusive territory. Mesco, Beaver City Nebr.

STRANGE ironing cord! Abolishes kinks, snarls. Prevents scorching. Saves time. Saves work. Saves electricity. 100% profit. Exclusive territory. Big offer free. Never-knot, Dept. 2-B, 4525 Ravenswood, Chicago.

PERMANENT Representative wanted for Hoover uniforms to call on restaurants, hotels, beauty parlors, doctors, nurses, others. Excellent income. Leads furnished. Equipment free. Hoover, Dept. AK-19C, 251 W. 19th, New York.

MAGIC disc heats water without gas, coal or oil. Tremendous seller. Big profits. Pocket samples for agents. Rush name for Free Offer. Nuway, Dept. X-132, Des Moines, Iowa.

AMAZING Fabricated ladies' fur coats. Only an expert can tell the difference. Big profits. Cost \$10.00. Write immediately. Ideal Coat Mfg. Co., Dept. S, 3856 Chicago Ave., Chicago.

BRAND new item for agents, salesmen. Just out. Sells on sight. Every man needs 3 to 12. Rush name for money-making offer. Remark Mfg. Co., Dept. 11, Butler, Ind.

DRESSES 10c. Hats 40c. Shoes 50c. Many other bargains—Used merchandise. Free catalogue. Send name on postcard. Fairmount, 162-PS Monroe Street, New York.

AT home, your own manufacturing business, making popular \$1.00 novelties. Cost you 3c to 15c. Everything supplied. Write So-Lo Works, Dept. D-824, Cincinnati, Ohio.

BIG money applying initials on automobiles. Easiest thing today. Free samples. Also, sideline salesmen for short order Decalcomania name plates. "Ralco," 1305 Washington, Boston, Mass.

AGENTS: Opportunity make money; book containing 127 successful business plans; home-office; send for free introductory booklet, Elite Co., 214-A Grand St., New York.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. G, Decatur, Ill.

AFTERNOONS Free! \$2,000 month taken in (exceptional, full time). Work home! Also War-time plan! Expect surprise! National-M, Box 1240, San Bernardino, Calif.

STRANGE Chemical sponge cleans wall-paper like magic. Banishes housecleaning drudgery. Sensational demonstration. Samples sent on trial. Rush name, Kristee 115, Akron, Ohio.

BUSINESS proposition resilvering mirrors, autoparts, reflectors, making chipped glass signs. Write, Sprinkle, Plater, 910, Marion, Ind.

500% PROFIT. Gold and silver colored sign letters. Offices—Stores. Large sizes 1c. Free samples. Modernistic, T-3000 Lincoln Ave., Chicago.

MEXICAN Curios sell on sight. Large profits. Free particulars. Samples 10c stamps. Marquez-IP, Apartado 1176, Mexico City.

SUCCEED with your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog Free. P. Thaxly Co., Washington, D. C.

500% PROFIT selling new "20-in-1" kitchen utensil. Retail 25c. Costs you \$1.00 a dozen or \$7.20 a gross. Sample 10c. New Method Co., PSM-86, Bradford, Pa.

FREE sample—amazing cleaner: sells homes, taverns, everywhere. Big profit—fast repeater. Besco, 5009-X, Irving Park, Chicago.

BIG money applying initials on automobiles. Write for particulars and free samples. American Letter Company, Dept. 47, Dunellen, N. J.

CAR-OWNERS to put up our signs. Fine offer for anyone traveling. (Not for kids.) Get details. Atlas Sign Works, 7941-K Halsted, Chicago.

AGENTS—300% Profit selling Gold Leaf letters; stores and offices. Free samples. Metallic Letter Co., 437 North Clark, Chicago.

BRUSH Salesmen, 200 items. Brushes, mops; marvelous magnetic brush, excels vacuum cleaner. Highest commissions. Neway Brush Works, Hartford, Conn.

SALESMEN to printers, service stations, garages, schools, taverns. Our line is profitable. Hageman's Laboratories, 224 North Washington, Minneapolis, Minn.

SENSATIONAL device cuts, trims own hair. Also money making formulas. Plaza Laboratories, AP, 1561 North Clark, Chicago.

SELL Soap. Make it yourself. Learn at home. No machinery needed. Posera, I-4545 Bartlett, Milwaukee.

AMAZING Zipper clothesline. Instant demonstration. Sells on sight. Dunn Mfg., Hempstead, N. Y.

EARN extra money taking magazine subscriptions. Lafayette Agency, Sea Cliff, N. Y.

YOUR name on mechanical pencil 25c. Take orders, charge 50c. Adcrafters, LaCrosse, Wis.

SELL Fascinating Jitterpups and carded merchandise. Dixie Supply, Rosslyn, Va.

ANTIQUES, RELICS INDIAN GOODS

INDIAN relics, Confederate bills, coins, gems, crystals, minerals, curios; catalog 52 illustrations 5c. 100 ancient arrowheads \$3.00. Tomahawk head 50c. H. Daniel, Hot Springs, Ark.

RELICS; Blunderbusses; Pepperboxes; Antiquities; Minerals; Curiosities. Beautiful Catalogue 10c. Museum, Rutland, Ill.

SWORDS, Rapiers, Daggers, Pistols. Catalog 10c. Robert Abels, 860½ Lexington Avenue, New York.

12 ARROWHEADS, spearhead, birdpoint, scalper, pipestone \$1.00. Museum, Rutland, Ill.

35 GENUINE Indian arrowheads, \$1.00. Catalog. George Holder, Glenwood, Ark.

AUTHORS' SERVICE

SHORT stories revised, typewritten, marketed. Hursh, Box S-1013, Harrisburg, Penna.

AUTOMOBILES

NEW Fifth edition Automobile Racing Book. Tells how to build dirt track bodies, frames, engines. Records, superchargers, rules, formula, plans, stock conversions, roadster racing, fast Fords. \$1.00 postpaid; \$1.14 C.O.D. Ray Kuns, Department 240, Madisonville, Cincinnati, Ohio.

GARAGE owners and mechanics can now purchase direct at full factory discount Triple-X alloy steel self-locking piston rings. Nationally distributed. Guaranteed performance. Stop oil pumping. Re-boring unnecessary. Write for sample and details. Triple-X Co., 3801 South Racine, Dept. 201, Chicago.

SUPERCARGERS \$3.00. Guaranteed mileage increase 20%; power 10%. University of Detroit test. Any car; give make, year. Wrench installs 15 minutes. John Hanley, Manufacturer, 5719 Loraine, Detroit, Mich.

MIDGET racers and accessories, two-passenger roadsters, midget motorcycles, motorscooters, bicycles. Complete line motors, wheels, parts, plans, construction kits. Handbook catalog, 90 illustrations, 20c. Midwest, Box 1959-Q, Chicago.

GASOLINE saving device, \$1.00. Ford V-8's, 1934-1940; Chevrolet, 1935-1940; Walert Co., 3429 No. 10th St., Milwaukee, Wis.

INDIANAPOLIS Miller Supercharger Racer—Ready to run for 1940—Priced right—Trade. H. Kohlert, St. Charles, Ill.

AUTO SUPPLIES & EQUIPMENT

CONVERT your car to burn Diesel oil. Save up to 70% fuel costs. Cheap installation. Wonderful performance. Proven factory method. Different and better. Costs nothing to investigate. Write for free circular No. 3. Harrington Company, 201-204 Manchester Bldg., Portland, Ore.

BARGAINS—Compressors, welders, battery chargers, car washers, attractively priced. Terms, trial. Write for bargain list. Hobart Automotive Supply, Box P-2403, Troy, Ohio.

STOP Thief—Concealed anchor chain for gasoline or radiator caps—15c; 2-25c. Gracey and Sons, Greenwich, Conn.

AVIATION

GET into Aviation! Wonderful opportunities open! Big money paid! Prepare at this Lincoln Government approved school for position as pilot, mechanic or aeronautical engineer. We assist graduates in locating positions. Part-time employment for board and room while training. Write today for complete information. Lincoln Airplane & Flying School; 2103 Aircraft Bldg., Lincoln, Nebr.

100 AIRPLANES \$50 up. Without motor \$20 up. Terms. Send 25c for complete catalogue. Used Aircraft Directory, Athens, Ohio.

AVIATION Apprentices: Airminded Young Men interested in training for entering Aviation as Apprentices see ad on page 50.

PROPELLERS for airplanes, sleds. Ice-sled blueprints, supplies. Catalog dime. Lorenzen Propeller Co., Niles, Mich.

AEROSLED Construction information 10c. Aerosled Sedan \$150.00. Adastik Bros., Grand Rapids, Mich.

LEARN to fly free. Folder, dime. Ohmeyer, Box 391B, Hempstead, N. Y.

BABY CHICKS

COLONIAL Chicks low as \$5.40 per 100. World's largest hatcheries. Leading breeds. Also sexed and Hybrids. Big chick Almanac Free. Colonial Poultry Farms, Box 1008, Shenandoah, Iowa.

BATTERIES, GENERATORS, ETC.

EDISON storage batteries for lighting and power. Non-acid. Odorless. Fifteen year life. Five year unconditional guarantees. Reasonably priced. Tremendous savings in battery and light plant combinations. Free illustrated literature. See-Jay Co., 87 Sterling Ave., Yonkers, N. Y.

EDISON lifetime storage batteries for light and power. Eliminate acid battery diseases. Long guarantee. All kinds rebuilt generating plants, motors, and miscellaneous articles at bargain prices. Free interesting literature. W. Hawley Smith Company, Croton Falls, N. Y.

110 AC Automobile fan belt generators. Easily installed, perfect performance. Operates amplifiers, movies, etc. LeJay Manufacturing, 123 LeJay Bldg., Minneapolis, Minn.

BLUEPRINTS AND PLANS

7000 AMAZING Novelties, 604 page catalog, 30c. Johnson Smith, Dept. 511-B, Detroit.

BOATS, OUTBOARD MOTORS, ETC.

MARINE Power. Easily convert any Ford motor (domestic and foreign) with Osco Parts and Kits. Complete Catalogue 25c (coin). Osmitson, 3648-P Lawrence St., Philadelphia, Pa.

BUILD Electric Outboard from automobile generator. Operates with car battery. Complete plans and catalog 10c. LeJay Manufacturing, 523 LeJay Bldg., Minneapolis, Minn.

OUTBOARD Motors. Used and Rebuilt. Save money. Used parts. Bargain list free. Crandall-Hicks, 955 Commonwealth, Boston, Mass.

BODY-BUILDING COURSES

EXERCISE equipment, courses. Special offers! Free booklet. Good Barbell Co., Dept. 6, Reading, Pa.

BOOKS, MAGAZINES, NOVELTIES BOUGHT & SOLD

EXCELLENT sparetime profits! Taking Subscriptions—2500 magazines. Agent's confidential catalogue, complete starting supplies free. Department 151, Pines, 583 Monroe, Brooklyn, N. Y.

PRETTY Girl photos, books, novelties. Catalog 10c. E. G. Specialties, PS, Carnegie, Penna.

RARE snappy books, pictures, novelties, hygienic goods. Where to get. We tell you. List only 25c. Esse Co., 5427-C Harford Ave., Baltimore, Md.

PHOTOGRAPHS by McGoldrick; samples, listings, 35c. Albert McGoldrick, Mansfield, Mass.

BOOK-Magazine exchange. Bargains galore! Catalog free. Nu-Ideas, Carrollton, Ill.

RARE, snappy photos. Set of four \$1.00. United, Casco, Wis.

BUILD IT YOURSELF

BUILD power Scooters, midget cars. We supply tires, wheels, motors. Lowest prices. Send 10c for plans, etc. Bild-Ur-Own Devices, Dept. 2-B, 536 North Parkside, Chicago.

64 PAGES plans, details. Construct midget racer from junk yard parts. 3 midgets, 25c. Plans for flying passenger plane, 25c. 604 page novelty catalog, 3c. Johnson Smith, Dept. 511-B, Detroit.

MOTORSCOOTERS. Midget Cars! Easily built. Complete plans and literature on wheels, tires, motors, etc., 10c. Hon-saker, Masontown, Pa.

DIVING helmets; build your own. Economical, practical. Complete information \$1.00. Alden Hutchins, Thorndike, Maine.

BLUEPRINTS and detailed instructions for building new simplified garden tractor, \$1.00. William Tanger, Bellefontaine, Ohio.

BUILD streamlined plywood Kitchen Cabinets. Plans 25c. Roger Underwood, 4617 Johnson Ave., Western Springs, Ill.

BUSINESS OPPORTUNITIES

WAR and Oil. War equipment must have oil in exceedingly large quantities and this fact makes our plan a Winner! It's simple, but effective. How you can Cash in pertaining to oil. Guaranteed legitimate. If you can use any extra cash, order this plan today. Just a 25c coin, no stamps, for this unique money maker. Royal Keystone Enterprise, Berryville, Ark.

PLASTEX Industries offer industrious men an opportunity to start a business of their own, manufacturing art goods, novelties and utility products in Plastex and marble imitation. 15c material makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings big returns. We are now placing big chain store orders with our manufacturers. Ambitious men have chance for real prosperity. Plastex Industries, Dept. S., 1085 Washington Ave., New York, N. Y.

FORDS Portable Hammermill operators make regular weekly net earnings, \$50, \$75, \$100 and more. Fords' exclusive Molasses Impregnator gives operators big competitive advantage. Equipment may be purchased 25% down, balance from earnings. Write for particulars about this safe, sure, profitable year-round business. Myers Sherman Company, 1429 12th, Streator, Ill.

ANNOUNCING new home study course in commercial baking. Good field for ambitious men. Nearly depression proof business. Common school education sufficient. Send for free booklet "Opportunities in the Baking Industry" and requirements. National Baking Institute, 3601 Michigan Ave., Dept. 1742, Chicago.

EASY Sales! With sensational new automatic floor waxer, cleaner and polisher—"all in one." Retail only \$1.95. Your profit 100%. It's the easiest proposition to sell and a great profit maker! Write at once. Free sample offer. Smith Mfg. Co., Dept. F, 4 Birnie Ave., Springfield, Mass.

PROFITABLE magazines for Classified advertisers! 24-page brochure, "Publication Directory of Classified Advertising Markets" lists 850 publications (with addresses) according to industries, trades, services. \$1.00 postpaid. Cortlandt Advertising, 15 Park Row, New York City.

FREE Amazing folder about artificial marble flooring. Covers wood or cement floors. Fireproof. All colors. Low cost "Ornamental Casting"—Concrete—Plaster—Statuary—Garden furniture—flexible molds—liquid marble. Creative Publishers, P.S.1, Glencoe, Ill.

SELL by mail! Books, novelties! Bargains! Big profits. Particulars free. C. Elfco, 438, North Wells, Chicago.

JEWELRY—Bracelets, bairpins, millinery ornaments, earrings, religious medals, etc., easily cast and set with imitation diamonds. Exceptional profits in this new business which offers opportunity to turn full or spare time into money. Complete outfit includes material and everything needed for production. No experience necessary. Write for free booklet describing this fascinating work. United Jewelry Manufacturers, Dept. B, 1692 Boston Road, New York.

MORE sales, more profit, come from use of white space as shown here. Yet the added cost is small. For details, drop a postcard to Classified Ad. Mgr., 11th Floor, 353 Fourth Ave., New York, N. Y.

WE help start you in business, furnishing Outfits and Instruction, operating "Specialty Candy Factory" home. Men-women, opportunity to earn good steady income, all or spare time. (Our 31st year.) Booklet free. Ragsdale Candies, Drawer 14, East Orange, N. J.

COLOR Concrete with chemicals. Stucco-rock. Cement Artistry. Wishing-wells. Spin concrete pottery. Benches. Miniature castles, water-mills. Cold-glaze, water-paints, marbling. Sample 10c. Hollywood CementCraft, 8530 Wonderland, Hollywood, Calif.

AMAZING profits "Building Home Coolers." Entirely new business. Unlimited possibilities. Enormous demand. Experience not required. Tremendous opportunity to build big paying business. Write today. Helm Mfg. Co., Decatur, Texas.

START Potato Chip business in your kitchen. There's money in Potato chips for everyone; also Krispy cheese chips, golden corn chips; 3 formulas, 50 cents; guaranteed. Joe Syc, 2712 Geimer, Detroit, Mich.

MAKE Artificial marble, glazed tiles, uncanny. Tabletops, plaques, floors, hones, novelties. Hard, fireproof, inexpensive, cement secrets. Brilliant tile and liquid rubber samples 3c. John J. Payn, 945 Grande Vista Ave., Los Angeles, Calif.

"NEW Money Makers." 70-page mailorder magazine, prints hundreds new, novel sparetime plans each month. Copy, 10c. K. Marvin, Publisher, 330 South Wells, Chicago.

M. M. Earned \$267 three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3848 Lincoln Ave., Dept. 129, Chicago.

GOOD Paying Business silvering mirrors, plating autopaarts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. E, Decatur, Ill.

127 WAYS to make money, in home or office, business of your own. Full particulars free. Elite Co., 214-A Grand St., New York.

CAPITAL raised by simple methods. Financing explained. Send \$1.00 for ten money raising plans. Executive's Promotion Service, Washington, D. C.

FOR an extremely profitable lifetime business, operate a Collection-Credit agency. Free folder. Cole Associates, Dept. S, Syracuse, N. Y.

SOUTH American employment—Get facts and suggested application form 25c. South American Frontier Association, 253 Plymouth Bldg., Minneapolis, Minn.

DISTRIBUTORS—Salesmen, new model envelope sealer. Sells on demonstration at \$2.50. Seals 40 a minute. Kendal Sealer Co., East Jaffrey, N. H.

SUCCEED with your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog Free. P. Thaxly Co., Washington, D. C.

AFTERNOONS Free! \$2,000 month taken in (exceptional, full time). Work home! Also War-time plan! Expect surprise! National-L, Box 1240, San Bernardino, Calif.

START the New Year right. Make big profits operating your own business at home. Free details. Atlas Service, Red Lodge, Mont.

INVENTION Finance Magazine, 80-N Wall Street, New York. For inventors. Free particulars.

HOW and where to obtain capital. Particulars free. Star Service, Wapakoneta, Ohio.

WHERE to buy at lowest wholesale prices. Information free. Yorena, Box M-312, Bayonne, N. J.

RUBBER molds. Make yourself. Formulas, instructions 25c. Kemikon, Park Ridge, Ill.

CANE Chairs. Good profits. Full instructions, \$1.00. Robert Hutchins, Thorn-dike, Maine.

START you in business. Popcorn machines. Potato chip outfits. Long Eak-ins, 2066 High St., Springfield, Ohio.

SOAP Making. Learn at home. No machinery needed. Posera, O-4545 Bartlett, Milwaukee, Wis.

500% PROFIT. Operate America's only low priced penny merchandise vendors. Fielding Manufacturing, Jackson, Mich.

FASCINATING, profitable "Fixit" Service taught. Houlgate, Station C, Pasadena, Calif.

MIRROR resilvering offers great opportunities. Write: Joyce Mirror Studios, 12461 Dresden, Detroit.

110 WAYS to make money that pay well: 50c postpaid. S. Kominz, 330 South Goodman, Rochester, N. Y.

RECEIVE stacks of mail: Your name listed in 10,000 directories 25c. Liberty Sales Service-B, Sheboygan, Wis.

110 WAYS to make money at home. Write: Service Bureau, Box 4079, South Edmonton, Canada.

HANDY men. Earn money home operating Community "Fix-It" Shop, Stafford, Makanda, Ill.

YOUR own business. Particulars. Send stamp. Whipple, Whitesboro, New York.

MAKE door mats from junk tires. Kowell, 5372 St. Clair, Detroit.

CASH paid for insects. See Sinclair display advertisement on page 51.

CAPITAL Seekers—Put your project before 260 Key-Men. Cost trifling. Details free. Amster Leonard, Fox Theater Bldg., Detroit, Mich.

CAMERAS, PHOTO SUPPLIES

FREE—Guide to everything photographic. New 1940 Camera Catalog—Handbook just issued. 84 pages containing over 2000 items, 300 pictures. Latest camera models, new prices. New accessories, enlargers, lens, dark room needs, movie cameras, etc. Also used camera bargains. Liberal allowance for your old equipment. Send for free catalog today. Abe Cohen's Exchange, for 30 years "The House of Photographic Values," Dept. C1, 142 Fulton St., New York, N. Y.

CAMERAS and supplies. Free illustrated catalog listing everything photographic—still and movie cameras, films, lenses—at tremendous savings. Hundreds of bargains, new and used. All guaranteed. We take your old camera or equipment in trade. Write now for your free copy of our newest money-saving bargain book—just out! Limited edition. Hurry! Central Camera Co. (Photographic Headquarters since 1899), 230 S. Wabash, Dept. B-182, Chicago, Ill.

FOR 30 years why shoppers write Bass: A few specials: 35 mm. Candid Midget, F:4.5 Anastigmat, \$12.50. Kodak Vollenda, F:3.5 lens, Compur shutter, \$22.50. Contax I, Tessar F:3.5 lens, \$72.50. Cine-Kodak Model B, F:3.5 lens, \$22.50. Send for big 66-page Cine catalog and Still Camera catalog. Dept. SP, Bass Camera Co., 179 W. Madison St., Chicago, Ill.

AMATEUR Photographers attention! Improve your hobby of picture taking and learn how to make money with it. Write today for a copy of our 40-page book catalog and for a free sample copy of American Photography. Contains articles and pictures of the world's foremost writers and pictorialists. Camera House 141, 353 Newbury Street, Boston, Mass.

OIL coloring photographs a fascinating hobby or profitable business. Learn at home by easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 3601 Michigan Ave., Dept. 1741, Chicago.

MEXICO? Wanted: Your name and address for literature and prices of finest German cameras, binoculars, movies. Foto Mantel: Apartado 1459 Ven. Carranza 11, Mexico City. No. 111.

MAKE money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Interesting booklet and requirements free. American School of Photography, 3601 Michigan Ave., Dept. 1742, Chicago.

CAMERA Repairing. Bellows made to order, shutters repaired. Bellows made to fit, all standard cameras! United Camera Co., Inc., B-1515 Belmont, Chicago.

ENLARGER \$1.59. Enlarges eight times size of small negatives. Guaranteed. Paramount Sales Company, 89 Dudley St., Boston, Mass.

20% TO 40% discount on films, paper, still or movie cameras. Write: Paramount Co., 327-PS, East 92nd St. New York.

25' EASTMAN Plus-X or Super-X 35mm film, \$1.00 postpaid. Economy Photo, Dept. 401, Greensburg, Pa.

U-ASSEMBLE 4x6 Photo printer kit \$3.00. B. Hill, Neosho, Mo.

CARTOONING, SIGN PAINTING, DRAWING AIDS

AMATEUR Cartoonists—earn up to \$35.00 week, copying and duplicating advertising cartoons. Adservice, Argyle, Wis.

CHALK TALK STUNTS

HOW to Chalk Talk. Complete instruction in this fascinating form of entertainment, by a famous professional. Shows how to draw trick pictures, arrange a program. 52 original illustrations showing how pictures are started and completed—all sure-fire hits. Includes humorous talk for delivery while drawing. Postpaid, \$1.00. T. S. Denison & Co., 203 N. Wabash, Dept. 33, Chicago, Ill.

LAUGH producing program, \$1.00. Illustrated catalog 10c. Cartoonist Balda, Oshkosh, Wisc.

CHARTERS

DELAWARE charters; complete service \$35.00. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Del.

CHEMICALS & APPARATUS

CHEMISTRY Laboratory apparatus and chemicals for industrial, analytical, and experimental laboratories. Complete supply service for students taking correspondence school chemistry courses. Send 3c postage for free 44 page catalog. Dept. M26. Biological Supply Co., 1176 Mt. Hope Ave., Rochester, N. Y.

HANDBOOK for Chemical Experimenters, illustrated, hundreds of experiments, postpaid 50c. Experiment booklet, 15c. Chemical catalog, 5c. Reading Scientific Company, Reading, Penna.

FREE: 40 page catalog of chemical and laboratory supplies for amateur chemists. Wollensak microscopes and supplies, scientific books at big discount. J. C. Winn, Dept. JC-2, 124 West 23 Street, N. Y. C.

FREE chemistry catalog. Supplies at 5c. Equip complete laboratory. Send 3c for postage. Kemkit Scientific Corporation, 397B Bridge Street, Brooklyn, N. Y.

LABORATORY Spectroscope for chemical analysis \$2.50. McCutting Sons, Campbell, Calif.

CHEMISTRY Course (slightly soiled) at bargain. Particulars, B. Shapereau, 620 E. 8th St., Brooklyn, N. Y.

FREE catalogue. Chemistry, mineralogy, biology, microscopes, telescopes. Tracey Laboratories, Evanston, Ill.

CHEMICALS in 5c quantities. Catalog 5c. Fleischer's Laboratories, Everett, Mass.

DETECTIVES

BECOME practical scientific investigator. Modern, illustrated course. Thorough training by former agent U.S. secret service. Particulars free. International Secret Service Institute, PS-20, Hoboken, N. J.

DETECTIVES—Work home—Travel. Experience unnecessary. Write, Wagoner, 2640-P Broadway, New York.

BECOME a detective. Opportunity to earn while learning. Free detective particulars. Raymond Stults, Bristol, Ind.

DOGS, BIRDS, PETS

SAINT Bernard Puppies on approval—reasonable too! Photographic prospectus free. Royal Kennels, Chazy, New York.

BLOODHOUNDS. Easy to train. A.K.C. stock. \$50.00 each. Mrs. Lucas Combs, Lexington, Ky.

COTTONTAIL Rabbits, coon dogs, bullfrogs. Vol Brashears, Berryville, Ark.

STANDARD Rabbit Journal, Milton, Pa. Year 50c. Sample Dime; Supplies.

EDUCATIONAL & INSTRUCTION

ASTROLOGY—Analysis scientifically. Made easy. Information Free. WEZ Planetarium, 558S, LaJolla, Calif.

STEADY job—good pay. Be an expert meat cutter. Sound, essential business. People must eat. Demand for trained meat cutters greater now than ever before. Intensive, short course, actual practice makes you a fully qualified, experienced. Union meat cutter (union card guaranteed—furnished free) on completion of course in six weeks. Job help. Pay after graduation. Write for details. We have no salesmen. National School of Meat Cutting, Dept. O-3, Toledo, Ohio.

REAL jobs open—Equip yourself by learning auto, Diesel, aviation mechanics, welding, body and fender quickly! Real opportunity for real job. Write nearest school for low tuition rates. Information free. Dept. F-3, McSweeney, Detroit, Mich., or Kansas City, Mo.

CORRESPONDENCE courses and educational books, slightly used. Sold. Rented. Exchanged. All subjects. Satisfaction guaranteed. Cash paid for used courses. Complete details and bargain catalog free. Send name, Nelson Company, B-203 Manhattan Building, Chicago.

MEN wanted. Auto-Diesel Mechanics. We pay your railroad fare to Nashville. Let us train you to be an expert mechanic and help you get a good job. The cost to you is small. For free booklet write Nashville Auto-Diesel School, Dept. 269, Nashville, Tenn.

AIR Conditioning—Electric Refrigeration. Rapid growth creates big demand for trained men. Earn up to \$35-50 weekly. Write for Free facts. Utilities Engineering Institute, 404 North Wells, Dept. 302, Chicago.

ELECTRICITY—new theory simplifies electricity. New method of training reduces cost from 20% to 60%. Details free. Write Sunbury Engineering Works, Box 129, Sunbury, Pa.

USED Correspondence Courses and educational books sold or rented. Inexpensive. Money-back guarantee. Write for free catalog listing 4000 bargains. (Courses bought). Lee Mountain, Pisgah, Ala.

CLAIM Adjusting. Excellent pay. Investigate tragic accidents, fires; outwit fraudulent claimants. Burns School. Keystone Building, Pittsburgh, Pa.

LEARN watchmaking. Material to start \$1.00. Wholesale—Tool—Material—Watch catalog 10c. Stewarts, 721 Olive, St. Louis, Mo.

"UNCLE Sam" jobs. Many 1940 appointments expected. \$105-\$175. Particulars—list positions free. Franklin Institute, Dept. W43, Rochester, N. Y.

TECHNICAL Books—All fields. Catalog. Stamp. Kraftsmen's Press, Cos Cob, Conn.

INVENTIVE minded can become independent. Explanation free! G. Higbee, Cantil, Calif.

DRAFTING jobs often pay \$175.00-\$500.00 month. Qualify now. Details free. Write Monroe Institute, PS-102, Alton, Ill.

"THINKING for Money." Dollar bill. Hampton, 4003 Junius, Dallas, Texas.

ELECTRICAL SUPPLIES & EQUIP.

ALTERNATING Current bargains. $\frac{1}{2}$ horse, 1750 speed, capacitor motors \$12.90. Repulsion induction, 3450 speed \$10.50, 500 watt generators \$22.50, 2000 watt \$75.00. Others. Electrical Surplus Company, 1885 Milwaukee, Chicago.

ELECTRO-SCRIBE: Electric pencil writes—engraves all metals \$1.00. Health Lamp: Dual Ray—Ultra Violet—Infra red. Promotes Sun-Tan—Vitamin "D". Automatic—AC-DC current, \$3.90. Details. Beyer Mfg. Co., 4515-C Cottage Grove, Chicago.

BARGAINS—Arc Welders, also motor generator. Write for new bargain list telling needs. Hobart Bros., Box P-2401, Troy, Ohio.

MAGNET. Alnico, New Wonder Alloy lifts 50 times own weight. \$1.00. Science, P. O. Box 861, Minneapolis, Minn.

ENGINES, MOTORS, ETC.

BARGAINS—Plating generators, motor generator sets, also arc welders. New low prices for large and small shops. Trial—easy terms if desired. Hobart Bros., Box P-2402, Troy, Ohio.

BARGAIN $\frac{1}{2}$ H.P. motors, 60 cycle, 1 phase, 110 volt, 3600 r.p.m. like new, guaranteed. \$8.25. Send check to Erie Electric Motor Co., 120 Church St., Buffalo, N. Y.

PRICELIST free. Motors; grinders; drills; shavers; clocks; electrical appliances. Home Workshop tools. Mailorder Electric, 705 South Dearborn, Chicago.

RELIABLE Motor Winding books. Lessons, connecting diagrams, winding data. Introductory data selection, \$1.00. Motor Data, Box 7631, Kansas City, Mo. **ALTERNATING,** $\frac{1}{2}$ horse, 110 volt, induction motors. Guaranteed. \$7.25. Wilmet Auto Supply, 2247 St. Paul Ave., Chicago.

FARMS, OTHER REAL ESTATE

MORE new farm land. Washington, Minnesota, Idaho, western Montana, Oregon. Dependable crops, favorable climate. Write for impartial advice, literature and list of typical bargains. Specify state. J. W. Haw, 120 Northern Pacific Ry., St. Paul, Minn.

40 ACRES, near White River, unimproved; poultry land, \$175; \$5 down, \$5 monthly. Free list and literature. Hubbard, 269 Grossman Bldg., Kansas City, Kan.

FARM Bargains, 16 states, 100-page catalog free. Strout Realty, 255-ZB 4th Ave., New York City.

FENCING

BIG Money building—selling Electric fences. Tremendous demand. Lowest wholesale prices. Free information. Hughes, 4 Miami, Terracorp, Ohio.

FIELDGLASSES, TELESCOPES & MICROSCOPES

ASTRONOMICAL Telescopes, binoculars, cameras, microscopes; bought, sold, repaired. Send 10c for list of instruments desired. Rasmussen, Box 294, Amsterdam, N. Y.

MICROSCOPES, Slide making supplies, reagents and stains. Send for free circular M38. Biological Supply Company, 1176 Mt. Hope Ave., Rochester, N. Y.

CLASSIFIED RATE

35c per word
per insertion

CASH WITH ORDER

Smallest Ad—10 Words

For APRIL INSERTION, copy and remittance must be in this office January 22nd.

Mail your order NOW.

POPULAR SCIENCE MONTHLY
353 Fourth Ave., New York, N. Y.

TELESCOPES, Microscopes, Binoculars; 1940 bargain catalog free. Brownscope Co., 5 West 27th St., New York.

FOR INVENTORS

PATENTS—Before too heavy an outlay of time or money is made on an invention, a search of the Patent Office records should be made to determine as nearly as possible whether or not the same idea has been patented before. The cost of this search is small, while the value of the facts it uncovers is often considerable. We offer inventors and manufacturers a thorough, prompt, confidential search service—plus experienced counsel and assistance in every phase of Patent and Trade-Mark practice. Write for our new free book containing valuable information relating to patent procedure. Clarence A. O'Brien, Registered Patent Attorney, Dept. OB2A, Adams Bldg., Washington, D. C.

WE locate buyers meritorious patented, unpatented inventions. If will sell, reply immediately. Descriptive booklet, references, free. Invention Reporter, 3A-11236 South Fairfield, Chicago.

INVENTORS: Sell your unpatented invention with positive safeguards under patent laws. New, low-cost procedure. Complete details, free. American Patents Corporation, Dept. 30-E, Washington, D. C.

INVENTIONS developed. Reasonable, confidential, reliable. Hugo Zschau, 1952 Humboldt, Chicago.

INVENTORS: Send for free copy my 72-page book on patents. Reasonable terms. Prompt action. Confidential, personal service. L. F. Randolph, Dept. 768, Washington, D. C.

INVENTORS, get your own patent. We furnish everything with complete instructions. \$2.00. Craycraft Bros., Box 1161, Jacksonville, Texas.

HAVE you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 3-A, Washington, D. C.

FOR a stronger patent at lower cost, make your own search first. Particulars free. M. J. Martin, 100 East 42nd, New York City.

FORMULAS, PLANS, ETC.

10,000 MONEY-MAKING Formulas, secrets, recipes. Make most anything. 900-page book, \$1.50 postpaid or C.O.D. (Foreign \$1.85). Catalog 3c. Adams-Brown, Chestnut Hill, Mass.

ANALYSIS. Research. Newest guaranteed formulas. Biggest catalog free. Nominal prices. Gibson Laboratory, Chemists, FA-1142 Sunnyside, Chicago.

REQUEST Formulae 50c! Assortment 110 manufacturing formulas, \$1.00! Literature free! Galluzzo, 409-S Trenton, Pittsburgh, Pa.

FORMULAS—Latest Money Makers. Literature free. E-Belfort, 4042 N. Keefer, Chicago.

THAXLY Formulas for perfect products. Accurate analyses. Catalog free. P. Thaxly Company, Washington, D. C.

FORMULAS. All kinds. Guaranteed. Catalog free. Kemico, 500, Parkridge, Ill.

GAMES—ENTERTAINMENT

PLAYS, operettas, musical comedies, complete minstrel first-parts with song programs, blackface skits, vaudeville acts, monologs, dialogs, recitations, juvenile plays and songs, musical readings, entertainments, make-up goods. Catalog free. T. S. Denison & Co., 203 N. Wabash, Dept. 26, Chicago.

7000 AMAZING Novelties, 604 page catalog, 3c. Johnson Smith, Dept. 511-B, Detroit.

HELP WANTED

EARN Cash at home! M. M. earned \$267.00, three weeks raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. Materials furnished. Starting crop guaranteed. We buy all crops. Book free. United, 3848 Lincoln Ave., Dept. 130, Chicago.

IF you are ambitious you can make good money with a Rawleigh Route. We help you get started. No experience needed. Steady work for right man. Write Rawleigh's, Box B-2-PSC, Freeport, Ill.

SALARIED Positions: \$2,500 yearly and up. Let us try to get one for you; small cost. Write for valuable information No. 26A. Executive's Promotion Service, Washington, D. C.

HIGHGRADE SALESMEN

ADVERTISING Book Matches—World's largest "Direct Selling" book match factory offers advance cash earnings calling on every type of business. Experience unnecessary; full, part time. Low prices for high quality; quick deliveries, help you get orders. Good repeat profits. Free kit, instructions. Match Corp. of America, 3433 West 48th Pl., Dept. N-2, Chicago.

DISTRIBUTORS, salesmen; sell to car, truck, tractor, boat, airplane, garages, filling stations, parking lot operators—A substance guaranteed to start rain drenched motors and keep them moisture-proof. Territory open, large profit, trial size 25 cents. EaZy Co., P. O. Box 2094, Ventnor City, N. J.

SALESMEN: America's finest sideline. 40% commission daily. 725 fast selling repeat items. Every business uses and must buy. No investment. Sales portfolio free. David Lionel Press, 312 So. Hamilton, Dept. RT, Chicago.

A Real future for you with Red Comet automatic fire extinguishers. Low price. Proved seven years. Splendid sales outfit free. Some good territory open. Exclusive. Write quick. 744 Red Comet Bldg., Littleton, Colo.

NEW! Low priced electric corn popper, does work of a \$300 machine, yet sells for only \$39.50. You make up to \$13.00 per sale. Experience unnecessary. Write today. Excel Manufacturing Corp., Dept. PS-240, Muncie, Ind.

DRESSES 10c. Hats 40c. Shoes 50c. Many other Bargains—Used merchandise. Free Catalogue. Send name on postcard. Fairmount, 160-PS Monroe Street, New York.

HOBBIES, COLLECTIONS

7000 AMAZING Novelties. 604 page catalog. 3c. Johnson Smith, Dept. 511-B, Detroit.

HOME CRAFTSMEN

LAWN Ornaments; easy to make, 20 full size patterns, birds, animals, etc., 25c; Dutch Boy, Dutch Girl, Sprinkling Girl, Fox Terrier, Scottie, bulldog, 15c each; any two 25c; Dutch Windmill, 36 inches high 25c. Entire collection, 27 patterns, \$1.00 postpaid. Wickman Co., Dept. 113, Dayton, Ohio.

SQUAREKNOTTERS! Make belts, handbags, etc. Quality cord samples with catalog free, beginners book, catalog and samples, 10c. Special! Regular \$1 book with 50c beginners outfit, all for \$1. P. O. Herwig Co., Dept. P-24, 121 Sands St., Brooklyn, N. Y.

GET Free Leathercraft instruction pamphlets, prices of leathers, tools, projects. Make extra money—gifts. Leather samples 5c. Wilder & Co., 1038 Crosby, Dept. A-2, Chicago, Ill.

MAKE beautiful Colonial pinup lamp, complete kit, including brass spinings, blueprint, instructions, \$1.25. Assembled \$2.75. B. R. Aircraft Comp., 6505 Maplewood Road, Baltimore, Md.

MEXICAN wood novelties easily made! 20 patterns and instructions 30c; 20 Western silhouette patterns 30c; 10 lawn ornament patterns 15c. Mexican Art-crafts, Eagle Pass, Texas.

70 PATTERNS, 20 lawn ornaments, 14 silhouettes, 20 novelties, 16 lawn ornaments, 30c each set, all for \$1.00. Modern Woodcraft, Saginaw, Mich.

SAW-ME-OUTS, 20 full size lawn ornament and novelty patterns 25c coin. Full directions, suggestions. Thriftcraft, 17534 Ohio, Detroit, Mich.

PATTERNS: Plywood novelties, silhouettes. Also transfer decorations. 170 items illustrated. Write: Wo-Met Shop, Ashburn, Ga.

MAHOGANY, Pine, Hardwood: Save up to 60%. Homecraftsman's Lumber Supply, Box 396, Newark, N. J.

7000 AMAZING Novelties, 604 page catalog, 3c. Johnson Smith, Dept. 511-B, Detroit.

BEAUTIFUL Cedar Gifts. Patterns, list 25c. Jno. Bold, Box 112, Culbertson, Mont.

KNOCKDOWN furniture, lumber, veneers. Illustrated catalog 10c. Giles-Kendall Co., Decatur, Ala.

MAKE a fine \$100 violin. Fraser, 2025 Stark, Saginaw, Mich.

INVENTIONS WANTED

SELL your own patent or invention. "Inventors Marketing Guide" lists 1200 concerns who buy ideas and patents. Includes sample letters showing exact procedure. Invaluable. Price \$1.00. Order now. Inventors Marketing Guide, Box 42, East Lansing, Mich.

WANTED—Meritorious patented, unpatented inventions. Booklet, references, free. Invention Reporter, 3B-11236 South Fairfield, Chicago.

INVENTIONS of merit wanted for marketing. Write for "4-Points of Service" bulletin. R. & S. Engineering Co., Dept. BS, 17 East 42nd St., New York City.

INVENTION Finance Magazine, 80-N Wall Street, New York. For inventors. Free particulars.

MODELS made of your ideas. Inventions manufactured. Write for estimates. Model Engineering, Dept. B, Osgood, Ind.

INVENTIONS Promoted. Patented or unpatented. Write Adam Fisher Co., 183-A Enright, St. Louis, Mo.

INVENTIONS Wanted suitable national distribution. Albert G. Burns, Alameda, Calif.

MACHINERY, TOOLS & SUPPLIES

HIGH quality power tools at lowest prices. Sturdy and efficient bench tools and model makers. Write for Free catalog. Arcade Mfg. Co., 1218 Shawnee St., Freeport, Ill.

DRILL Grinding Jig handles sizes 3/16 to 1 1/4". Can be mounted to bench grinder, hand or power. Literature on request. Tractor-Lite Co., Sidney, Iowa.

WRITE for Free large 1940 catalog of used and new tractor parts. Satisfaction guaranteed. Central Tractor Wrecking Co., Boone, Iowa.

PLASTICS, Brass, aluminum, DOWmetal, monel, stainless steel, gears, etc. Catalog 10c. Hobby Supply House, Box 2014, Pittsburgh, Pa.

MAGIC TRICKS, PUZZLES, JOKER NOVELTIES

604 PAGE catalog listing over 7000 novelties, puzzles, tricks, hobby kits, knives, guns, jewelry, punchboards, make-up supplies, optical goods, seeds, radios and kits, cameras and supplies, guns and revolvers, etc. Only 3c. Johnson Smith, 511-B, Detroit.

500 MAGIC tricks in wonderfully illustrated Catalog only 10c! Professional Catalog 10c. Lyle Douglas, Station A-1, Dallas, Texas.

WORLD'S largest magic shops professional catalog 25c. Holden, P-220, W. 42nd St., New York.

ENTERTAIN with Magic! Catalog 500 easily learned tricks 10c. Professional catalog 10c. Lyle Douglas, Station A-1, Dallas, Texas.

LARGE Magic catalog 25c. Hundreds of tricks. Chicago Magic Company, A-2300 N. Mason Avenue, Chicago.

AMAZE and mystify! Catalog 500 pocket-parlor tricks 10c. Professional catalog 10c. Lyle Douglas, Station A-1, Dallas, Texas.

EASY to perform magic tricks with Heller's Book of Magic. Only 30c. Otto, Box 864, Sequim, Wash.

MANUFACTURING

INVENTIONS developed, manufactured in any quantities. Low cost. Metal specialties, stampings, dies, models built. Free estimates. Write for "4-Points of Service" bulletin. R. & S. Engineering Co., Dept. BS-1, 17 East 42nd Street, New York City.

AN individual service for inventors. Developing models—manufacturing—dies—tools—special machinery. H. & H. Tool & Mfg. Co., 308 E. 3rd St., Cincinnati, Ohio.

PRECISION Lathe work, grinding, pattern making, drafting. Write Toolroom, 573 Fox, Aurora, Ill.

MANUFACTURING, any material, any quantity. Inventions developed. Milburn, Burlington, Ky.

MILK GOATS

FOR Free literature and magazine address: Goat World, Vincennes, Ind.

MISCELLANEOUS

CORRESPONDENCE courses and educational books, slightly used. Sold. Rented. Exchanged. All subjects. Satisfaction guaranteed. Cash paid for used courses. Complete details and bargain catalog Free. Send name. Nelson Company, B-204 Manhattan Building, Chicago.

DRUG Sundries, specialties, supplies, etc. mailed direct by manufacturer. Send for free mail-order catalog, saving 75%. Mail-Order, Dept. 5A, Box 231, Hamilton, Ontario.

WANTED: Hear from parties interested gold or silver ores, buried or hidden treasure. Bergman's Instrument, \$5.00. Particulars free. Henry Bergman, Box 70-B, Springfield, Mo.

FIRE alarms; \$2.50. Safeguard life and property constantly. Write Little Watchman, 1219 South Sixteenth, Milwaukee, Wis.

RECEIVE gigantic mails, magazines, samples. Your name in numerous mailing lists 10c. Waltman, 460 Grand St., New York.

PRINT your own pictures, 2 minutes (daylight) from any negative, on cards, stationery, cloth. Kit \$1.00. Box 291A, Iron River, Mich.

FREE literature how to locate buried treasure and minerals. Fisher Laboratories, Palo Alto, Calif.

ALASKAN, Gold nuggets, for gifts, or souvenirs, from a prospector. \$1.00, \$2.50 and \$5.00. M. Shimrock, Manley Hot Springs, Alaska.

REPORTERS Press cards, 25c. Caswell Service, 2121-6th Ave., Altoona, Penna.

MODELS & MODEL SUPPLIES

MODELS, Your ideas developed into practical working models. 30 years successful experience; thousands of satisfied customers. Confidential service guaranteed. Bank references. Send 3c postage for our large booklet: "Making Inventions Pay." Crescent Tool Co., Dept. PS., Cincinnati, Ohio.

POWER Models, Steam, gasoline, electric for Railways, ships, Metals, accessories. 84 page Catalog 35c. Charles Cole, Ventura, Calif.

SPEED! Model racing hull construction kits. Free literature. Enclose 5c for mailing. St. Louis Model Boat Co., Clayton, St. Louis, Mo.

ENGINE Catalogue castings, supplies, 25c. Howarco, P-2417 North Ashland, Chicago.

THOUSANDS ship fittings, hundreds kits catalog 10c. Polk's, 429 Seventh Ave., New York.

LATEST Model airplanes. Money saving catalog, 10c. Deland, 80 First St., N.Y.C.

BUILD Miniature racing cars. List free. Northern Aircraft, S-2, Manitowoc, Wis.

BRASS Gears and model supplies catalog 3c. Pierce Model Works, Tinley Park, Ill.

RAILROAD Model Shop, Dept. P S, Dunellen, New Jersey. Catalog 10c.

MONEY MAKING OPPORTUNITIES

GRAB this amazing product. Proven by three years actual use. Seals punctures automatically. Run icepicks into tires without losing air. Auto and truck owners amazed and delighted. Whirlwind seller. Salesmen can make \$100.00 per week, distributors \$2,000.00 per month. Write immediately. Air-Seal Distributors, Inc., 8053 Beverly Blvd., Los Angeles, Calif.

SEVENTY Dollars a month in spare time possible. Every merchant needs our special announcement board. Send one dollar money order for sample. Specialties, Box 734, Pittsburgh, Pa.

BE a professional scrapbooker. Big fees. Unlimited opportunities. Can be done at home. No competition. No capital needed. Write to Scrapbookers Guild, 59 Park Place, New York, N. Y.

YOU'LL like resilvering mirrors, auto-parts, reflectors, making chipped glass signs. Write Sprinkle, Plater, 920, Marion, Ind.

WRITING, Contesting, Cartooning. Extra money without talent. Complete guaranteed instructions only 35c prepaid. S. Moore, 152 Broad, Newark, N. J.

MAKE Beautiful vases, urns, jars of synthetic pottery with my molds for few cents. Big profits. Write Morrow, 19 North "G" St., Pensacola, Fla.

"RAISE Earthworms for Profit." Information free. Stamp appreciated. Bureau Zoological Research, 106P Broadway, Peoria, Ill.

MAKE color-glazed concrete pottery, gravestones, tiles, floors, walls. Basement waterproofing, etc. Booklet, details 10c. National Potteries, Minneapolis, Minn.

EARN money addressing envelopes, circulars, typing. Information 10c. None free. Ace-PSMQ, 316 Empire, Birmingham, Ala.

AMATEUR Cartoonists—earn up to \$35.00 week, copying and duplicating advertising cartoons. Adservice, Argyle, Wis.

VALUABLE information. 600 answers \$1.00. Circular free. Posimo Cruz, 336 West Monroe, Jacksonville, Fla.

FIFTY Moneymaking Ideas, twenty are different Mailorder plans \$1.00. Postpaid. Hill's, 822 Carton, Flint, Mich.

BUILD Mail business from home. Read Mail Order News, sample 20c. Literature free. Julius, Amarillo, Texas.

MONEY Makers' Opportunity Digest Magazine—60 pages real opportunities, 10c. Lewis Co., 828-R Carpenter, Oak Park, Ill.

MONEY by Mail: new Mailorder Opportunities free. Harvey Teeple, Decatur, Indiana.

OWN your own business. Earn ten dollars daily. Protected territory. Dittman Service, Bus Terminal, Youngstown, Ohio.

CASH paid for insects. See Sinclair display advertisements on page 242.

MOTION PICTURE & SOUND EQUIPMENT

AMAZING Sale! Used 16mm projectors, guaranteed! For professional, church, home! \$160 Eastman Kodascope \$24.50! \$210 Kodascope \$48.75! \$49.50 Duograph \$9.95! \$139 Bell-Howell, \$49.50! \$125 Filmo, \$24.95! Many others; get list free. 16mm Bell camera f:4.5 \$3.99! 8mm Univex \$2.99! \$87.50 Filmo f:3.5 \$33.75. Odd 16mm soundfilm subjects 400' \$3.00! Silent 400' \$2.50! 16mm 400' reels, humidor cans 25c! Trades accepted. Monthly payments. Moggil's, 66 West 48th, New York.

ATTENTION Movie Makers: Cut your movie costs 50% with Solar film, America's foremost economy movie film. Write for prices of 16mm, 8mm films and special discount offer. For better films and faster service, write: Solar Film Co., Dept. H, 3827 Archer Ave., Chicago, Ill.

WRITE now for free catalog of movie equipment and film subjects. We are never undersold. Paramount Mfg. Company, Dept. M-14, Box 224, Back Bay, Boston, Mass.

16MM Trailers and titles with or without music. If you want deluxe professional made 16mm. trailers and titles, order from Filmmack, 843 S. Wabash, Chicago.

8-16MM films; sell-rent-exchange. Free illustrated catalogue (with sample art film 10c). Garden Exchange, 317 West 50th, New York.

OUTDOOR Film 100 ft. 16mm \$1.98. 25 ft. double 8mm 98c. Processing included. Free bargain lists. Home Movies, Box 216S, Easton, Pa.

ART film, sample 10c; lists free. Goodwill Company, Jackson, Tenn.

SAVE! Catalogue! Bulk film! Art films! Subjects! 423-SB, Williamsport, Penna.

100 FEET 16mm \$1.75. Projectors—Silent—Sound. Savarese, Woodcliff Lake, N. J.

8MM and 16MM Film Exchange. Home Movies, Box 608, Burbank, Calif.

MOTORCYCLES, BICYCLES & SUPPLIES

MOTOR marvel ready! Mead's sensational new Ranger Scooter goes 120 miles per gallon, 35 m.p.h.; ride, rent or sell for profit, pleasure. Dealers, Agents, write for Special Introductory offer, easy terms, free circular. Hurry! Mead Cycle Company, Dept. B-2, Chicago, Ill.

ALLOY Pistons \$3.00; Indian, Harley, Henderson, Excelsior, Cleveland, New and used parts for less. Cylinder grinding. Catalogue and wings pin 10c. Balak, 1115 Chestnut, St. Louis, Mo.

RECONDITIONED Motorcycles. New-used parts for all makes. Authorized Harley-Davidson Dealer. Whitman Motorcycle & Supply Co., 405-9 Southwest Blvd., Kansas City, Mo.

MOTORCYCLES, reconditioned. New, used, parts and accessories. All makes. Large stock. Bargains. Illustrated catalog, 15c. Indian Motorcycle Sales, Kansas City, Mo.

MOTORCYCLE bargains, lowest prices, bargain sheets for stamp. Motorcycle accessories. Rochester Harley Davidson Corp., 131 W. Main St., Rochester, N. Y.

1½ H.P. Engines suitable for scooters, cars, boats. At only \$14.95. Clear-Vue Company, Dayton, Ohio.

MUSIC, MUSICAL INSTRUMENTS

WANTED: Original poems, lyrics, songs by a recognized music organization. Our contracts Guarantee Publication, marketing; include expert collaboration, where required. We give you advantages not obtainable elsewhere. Send your material today. Music Publishers Agency, Dept. X16, Portland, Ore.

"SINGING made easy and the Mastery of the Voice" teaches tone placement, perfection, extended range. Immediate results! Popularly priced. Free Prospectus! Approved as Correspondence School under New York State Laws. Whitney Vocal Method, 245-B Wolfs Lane, Pelham, N. Y.

MUSIC composed to words. Rhyming Pamphlet on request. Phonograph recording of completed song. Send poem. Keenan's Studios, Dept. PS, Box 2140, Bridgeport, Conn.

LEARN Swing piano! Postal brings free folder. Christensen, 765 Kimball Hall, Chicago.

PIANO by ear. Free booklet. Day-V-Way, 13265 Michigan Ave., Dearborn, Mich.

FIFTY late phonograph records, \$2.50. Wurlitzer selective, amplified, 12 record phonographs, very cheap. Davis Sales Co., Syracuse, N. Y.

MUSIC engraving—printing. Engraved music plates mounted on wood usable on any type press. Waltee Brown Music Print, Boscobel, Wis. (Formerly Chicago).

SONGS, song poems, bought, published. Best offer, free advice. Metro-Melody Music Publishers, 1204 Sutter, San Francisco.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

RECORDING Songs, poems; Dollar per minute. Ray Turner, Hotel Tilden Hall, Champaign, Ill.

OLD GOLD, WATCHES

GOLD \$35.00 ounce. Ship old gold teeth, crowns, jewelry, watches—receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Co., 1500-B Hennepin, Minneapolis, Minn.

OLD STAMPS WANTED

I will pay \$100.00 each for 1924 1c green Franklin stamps, rotary perforated eleven (up to \$1,000.00 each if unused). Send 6c for large illustrated folder showing amazing prices paid. Vernon Baker, 444-PS-2, Elyria, Ohio.

PATENT ATTORNEYS

PATENTS—Before too heavy an outlay of time or money is made on an invention, a search of the Patent Office records should be made to determine as nearly as possible whether or not the same idea has been patented before. The cost of this search is small, while the value of the facts it uncovers is often considerable. We offer inventors and manufacturers a thorough, prompt, confidential search service—plus experienced counsel and assistance in every phase of Patent and Trade-Mark practice. Write for our new free book containing valuable information relating to patent procedure. Clarence A. O'Brien, Registered Patent Attorney, Dept. OB2B, Adams Bldg., Washington, D. C.

PATENT your idea. Write immediately for two free books, "Patent Protection" and "When and How to Sell an Invention." Fully explain many interesting points to inventors and illustrate important mechanical principles. With books we also send "Evidence of Invention" form. Prompt service, reasonable fees, forty-two years' experience. Avoid risk of delay. Address: Victor J. Evans & Co., Registered Patent Attorneys, 571-B Victor Building, Washington, D. C.

INVENTORS: Before disclosing your invention to anyone send for Form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and instructions. Sent free. Lancaster, Allwine & Rommel, 413 Bowen Building, Washington, D. C.

PATENTS: Personal, confidential services at reasonable cost. Preliminary information furnished without obligation. John B. Thomas & Co., 902 F St., N. W., Washington, D. C.

PATENTS—trade marks. Preliminary advice, book and disclosure form free. Personal service. Irving L. McCathran, 1050 International Bldg., Washington, D. C., Registered Patent Attorney.

INVENTORS: Send for free copy my 72-page book on patents. Reasonable terms. Prompt action. Confidential, personal service. L. F. Randolph, Dept. 340-A, Washington, D. C.

"INVENTOR'S Guidebook" containing advice about patenting, selling inventions, also "Recording Form." Free. Registered Attorney-Engineer Frank B. Ledermann, Tribune Building, New York.

PATENTS—Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 724 Ninth St., Washington, D. C.

"PATENT Particulars" and blanks, free, airmailed. Sterling Buck, P-629 F, Washington, D. C.

PATENTS

WE successfully sell inventions, patented and unpatented. Write for proof and tell us what you have for sale. Chartered Institute of American Inventors, Dept. 3-B, Washington, D. C.

PERSONAL

MEXICAN Legal Matters. Reliable Amer. Atty. Box 1736, El Paso, Texas.

WIN prize money: Booklet, "Successful Contesting," shows how, 10c postpaid. Bulletin listing \$100,000.00 prizes included. World Publishers, 4515-L Cottage Grove, Chicago.

SINUS Trouble. If a victim of Sinus or Catarrhal Infection. Write National Laboratories, Benj. Franklin Station, Washington, D. C.

ASTROANALYSIS Pays! Birthdate analysis 50c postpaid! Free details! Altiery, 1300 So. 9th, Philadelphia, Pa.

TYPISTS, home-work. Commissions. Working material 25c. Beach, Chicago Ave., Groton, Conn.

PERFECT eyesight without glasses. No drugs. Details free. Arthur B. Jacobson, Upsala, Minn.

HAND Writing analysis—Geoffrey St. Clair's course 25c. McChesney, 126 Barrera, San Antonio, Texas.

"MARRIED Harmony." Send dollar bill. Hampton, 4003 Junius, Dallas, Texas.

PHOTO FINISHING

TECHNIFINISH. 35 mm., 36 exposure rolls fine grain developed and perfectly enlarged to 2½" x 3¾" glossy prints, 75c. New exclusive methods and equipment make this low price possible. Cartridge reloaded with Eastman Plus X, 25c. One day service. Satisfaction guaranteed or money back. Write for postpaid mailing bags and information. Technifinish Laboratory, 108-C Lexington, Rochester, N. Y.

FINER finishing specials 25c. 6 or 8 exposure roll developed. Your choice—16 prints or 8 prints with 2 professional enlargements or 8 prints and one colored enlargement. 40 years of satisfaction behind Moen Tone Service. Moen Photo Service, 200 Moen Bldg., LaCrosse, Wis.

PHOTOGRAPHY for pleasure and profit. Prepare for profitable business or fascinating hobby at home. Common school education sufficient. Write for information and requirements. American School of Photography, 3601 Michigan Ave., Dept. 1721, Chicago.

ROLL Filmachine developed and your choice (1) 8 Finerfotos and 2 professional Bromide enlargements; or (2) 16 guaranteed Finerfotos or (3) 8 Finerfotos and one beautiful oil colored enlargement, 25c. Order by number. Prompt Service. Finerfotos, Box 898-18, Minneapolis, Minn.

LET us show you How and Where to Sell those photos. Increasing demand for pictures of unusual reader interest by syndicates, trade journals, etc., opens up money making field for amateur photographers. Write for particulars to Photo Sales Guide, Box 2625, Kansas City, Mo.

PHOTOGRAPHIC Enlargements from pictures or negatives: 5" x 7" 25c (5 for \$1.00); 8"x10" 39c (3 for \$1.00); 11"x14" (2 for \$1.00) cash or C.O.D. Photo Art Service, 505-PS Fifth Ave., New York City.

ROLLS developed. Two sets prints plus enlargement coupon, 25c. Reprints, 3c. Over 19 reprints, 2½c. Jones Studios, Davenport, Iowa. "Where the West Begins."

CANDID special: 35 Millimeter rolls enlarged to 3½"x4½", \$1.00. 18 Millimeter rolls, 60c. 3½"x4½" reprints, 3c each. Brown Photo Company, 1910-60 Emerson, Minneapolis, Minn.

ROLL developed, 8 beautiful enlargements 2 to 8 times larger, deckled edge, 116 or smaller, 25c coin. Reprints 3c each. Alden Photos, 258 Astor Sta., Boston, Mass.

35MM Rolls developed free. 3½" x 4½" enlargements, 36 exposures \$1.00. 18 exposures 60c. Univex rolls \$2.00. Reprints 4c. Send roll and money today. Minipix, Dept. 62, 100 N. LaSalle, Chicago.

FOR the discriminating amateur. Rolls developed and 2 prints each 25c. Reprints 3c. Superior workmanship. Same day service. Paramount Co., 327 E. 92nd St., New York.

AT Last! All your snapshots in natural colors. Roll developed, 8 natural color prints, only 25c. Reprints, 3c. Amazingly beautiful. Natural Color Photo, Janesville, Wisconsin.

ROLLS developed, two prints each and two free enlargement coupons, 25c; reprints, 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

20 REPRINTS 25c, 100—\$1.00. Roll developed 16 prints 25c. 5 x 7 enlargements 10c. 3—25c. Nordskog, 58, Maywood, Ill.

ONE day service, roll developed, 16 quality prints in attractive Agfa Snapfolio with cellophane pockets 25c. Pho-T-Pho, Box 24-G, Highland Park, Mich.

ROLL developed fine grain and all enlarged 2 to 8 times—8 exposure 25c; 16, 50c, 36, \$1.00. Enlargements 4c each. Young Photo Service, 406-E, Albany, N. Y.

FILM developed and printed returned same day with two enlargement coupons, 25c. Whitmore's Photo Service, Litchfield, Minn.

PROFESSIONAL, overnight service. Developed, printed, 2 enlargements, 25c. Fotoservice, 1942 Marlow, Toledo, Ohio.

ROLL developed—16 guaranteed neverfade prints, 25c. Beautiful 5x7 enlargement free. Dick's Photo Service, Louisville, Ky.

20 STAMP Photos and 2 8x10 enlargements from your picture, 50c. Grove Studio, Coupeville, Washington.

PROMPT Service! Rolls developed, two Velox prints each negative, 25c. Hensch Studios, Harrisburg, Penna.

SENSATIONAL Offer. Five 5 x 7 enlargements 29c. Cardinal Photos, Summit, N. J.

EIGHT Silvertone gloss enlargements or eight prints and two enlargements, 25c. Mayfair, Box 261-A, Toledo, Ohio.

ROLL developed, 16 guaranteed prints 25c. Smart Photo, Winona, Minn.

POULTRY & SUPPLIES

MAKE Money with poultry. Read America's leading poultry magazine for latest information. Three years \$1.00; nine months 25c. Poultry Tribune, Dept. C-91, Mount Morris, Ill.

LEADING Turkey magazine, devoted exclusively to turkey raising. Explains newest methods. \$1.00 a year. Turkey World, Desk 58, Mount Morris, Ill.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, LABELS

ATTRACTIVE 2-Color shipping labels, business cards \$1.00 thousand. Quantities cheaper. Stickers, blotters, Hammermill Bond letterheads, envelopes, displays, folders, etc. Cut prices, prepaid. Free samples. Certified Printers, 708-A Madison, Chicago.

HAMMERMILL letterheads, any color paper, ink; 300 8 1/2 x 11, \$1.48 postpaid—envelopes matching, \$1.15, 30 type styles. Samples. Woodruffs', 217-D Lewis, Duluth, Minn.

125 8 1/2 x 11 TWENTY pound Bond letterheads and 125 envelopes \$1.00 postpaid. Benneville, 907 West Roosevelt, Philadelphia.

BOND Letterheads, envelopes, \$2.75 thousand. Samples. Anything quoted. Irellan Printing Co., Berkeley Heights, Route 7, Dayton, Ohio.

CORRECTLY designed printing cheaper—quicker. Samples. Sicoan, 2038 Obear, St. Louis.

CUTS from drawings and photos 2x3" \$1.00. Joe Rek, 118 Gazette Ave., Lexington, Ky.

PRINTING & Mimeographing, best prices 150 envelopes \$1.00, 1000 letters mimeographed \$3.25. Printex, Vinton, Va.

50 SHEETS, 20 Envelopes, 25c postpaid. Western Stationery, Topeka, Kansas.

PRINTING OUTFITS & SUPPLIES

PRINT your own cards, stationery, circulars, advertising. Save money. Easy rules furnished. Print for others, big profits. Junior outfits \$9.25, senior outfits \$16.55 up. Details free. Kelsey Presses, H-8, Meriden, Conn.

HAND Presses, type and complete printers' supplies. Send stamp for catalog and new price list. P. Peiffer, 4 Columbia St., Newark, N. J.

MONEYMAKERS—Automatic card press: stationery embosser; hand press, \$8.00; ink, 15c; rubber printing outfit, 95c. Reid, B172, Webster, Mass.

SIX useful business, fraternal, dance cuts 50c. Republic, 7150-A Cottage Grove, Chicago.

PROFITABLE OCCUPATIONS

M. M. Earned \$267, three weeks, raising mushrooms in cellar! Exceptional, but your cellar, shed perhaps suitable. We buy crops. Book free. United, 3848 Lincoln Ave., Dept. 131, Chicago.

RADIOS, SUPPLIES & INSTRUCTION

RADIO engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Poplar St., Valparaiso, Ind.

S-M Crystal distance radio. Sensation. Kit—\$1.95. With speaker—\$2.95. C.O.D. Circuit only—25c. Esco-PS, Kansas City, Mo.

PLANS 18 distance Crystal sets, with "Radiobuilder"—year, 25c. Laboratories, 7700-T East 14th, Oakland, Calif.

RADIO kits—\$3.95 up. Single band; all wave, 5-10 tubes. Save 50%. McGee Radio, EP-10, Kansas City, Mo.

RADIOS: All types; Save 50%. Catalog free. Autocrat-B, 3855 North Hamilton, Chicago, Ill.

RARE COINS

QUICK Cash for your old coins. We pay big prices for wanted coins; certain 1909 cent, \$10; liberty head nickels before 1914 \$500; 1864, 1865 Indian head cents \$100 each; dimes before 1895 \$600; some worth \$6,000 each. Have you valuable coins in your possession? It will pay you to be posted—Send 15c for our illustrated coin catalog. National Coin Corporation, Uninc. (3), Daytona Beach, Florida.

FREE! Foreign coin, banknote, and large illustrated coin catalogue. Send 4c postage. Coin approvals sent. Tatham Coinco, Springfield-D50, Mass.

WANTED — Indianheads, Libertyheads, cents, nickels. Particulars and three rare notes given for 9c stamps. Southern Exchange, Box 1108, Houston, Texas.

COIN Collectors' Illustrated Catalog of coins, books and accessories 10c. James Randell, 407 South Dearborn, Chicago.

BRILLIANT—1939-S or 1939-D uncirculated cent and catalogue 10c. Landon, 901 Lucerne, Los Angeles.

6 COINS 10c. 111 coins, bills, tokens, \$1.00. Otto Oddehon, Overland Station, St. Louis, Mo.

15 NICE Coins, 25c. Blisshoff, 500 East 8th, Kansas City, Mo.

FREE coin list—have large stock. Keim, P.O. Box 103, Station A, Flushing, N. Y.

RUBBER STAMPS

DEEP letters! Two lines 25c. 3—35c. Ad-Crafts, LaCrosse, Wis.

SONGWRITERS

WANTED: Original poems, lyrics, songs by a recognized music organization. Our contracts Guarantee Publication, marketing; include expert collaboration, where required. We give you advantages not obtainable elsewhere. Send your material today. Music Publishers Agency, Dept. X16A, Portland, Ore.

WANTED. Poems, to be set to music. Submit for consideration. Transcription records made. Keenan's Studio, PS, Box 2140, Bridgeport, Conn.

SONG poems wanted to be set to music. Free examination. Send poems to McNeil, Master of Music, 510-PS-So. Alexandria, Los Angeles, Calif.

SONGWRITERS—Write today for free booklet "Building an Income Thru Songwriting." Songwriters Institute, 1234-J Broadway, New York.

FREE, inspiring booklet describing songwriting opportunities. Allied Music, Dept. 5, Box 507, Cincinnati, Ohio.

SONGWRITERS: Send your poem today for immediate consideration. Richard Brothers, 146 Woods Bldg., Chicago.

SONGWRITERS. Send original poems. America's finest service. Variety, Dept. G, Salem, Ind.

SONGWRITERS! Amazing, outstanding offer. Hibbeler, C-15, 2157 No. Avers, Chicago.

SONGPOEMS. Melodies. We'll help find publisher. Songland, "D4OPS-2", Thomaston, Maine.

SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY

HUNTING, fishing, trapping, outdoor equipment, used guns. List and catalog free. Howe Fur Company, Coopers Mills, Maine.

ARCHERY: Ideal sport and recreation. Complete instruction book, 50c. Catalog free. Chester Brown, 617 South State, Chicago.

ARCHERY Supplies. Catalogue free. Instruction book 50c. Midwest Archery, 2209-D East 75th, Chicago.

SINKER Molds: Make your own sinkers. Free folder. Reading Instrument Co., Box 78, Reading, Pa.

STAMP COLLECTING

FREE—Entire new U.S. issue of "Famous Americans." This issue consists of 35 commemorative stamps of which 5 will be issued every month starting January. We will send the entire issue Free to collectors on our active mailing list and will also send Free at once an attractive specially prepared album for this issue, which contains the history and achievements of each of the 35 famous Americans. Get on our mailing list Now and get the entire series Free. Write for that Free album today. We will send it at once with an attractive approval selection. References please. Approval Headquarters, Globus Stamp Company, 268-4th Ave., New York City, Dept. 217.

GIANT packet 200 all different from Africa, South America, Asia, South Sea Islands, etc. Includes world's smallest stamp; triangle and diamond-shaped stamps; animal stamps. Nicaragua "Will Rogers" airmail; many others. Also packet 17 different United States (cataloging 50c); all obsolete, including \$4 denomination, commemoratives, etc. Total catalogue price over \$5.00! Everything for only 5c to approval applicants! Mystic Stamp Company, Dept. 55-N, Camden, New York.

STAMP Outfit free! Scarce airmail triangle from the Mozambique Co.; genuine North Borneo (Buffalo Transport); fine packet Jungland Countries only (a real thriller) including Sarawak (White Rajah), Belgian Congo, Perak, Sudan (Desert Scene), etc., also set U. S. stamps (50 years old!) and extra Surprise Gift—this big outfit absolutely free with dandy approvals and lists! Send 3c for postage. Midwood Stamp Company, Dept. 5R, Midwood Sta., Brooklyn, N. Y.

FREE! World's smallest triangle, giant diamond-shaped stamp, Bolivia triangle, packet old U.S., set twentieth-century Philippines, set Brazil patriots, Devil's Island, Congo Cannibal, Danzig, Tunisia, Soudan, West Indies, South Seas, Asia, Africa, BrCols., pictorials, commemoratives, airmails, bicolors, perforation gauge, millimeter scale. Postage 3c Approvals. Davidson, 2297-S 6E., Salt Lake City, Utah.

FREE! The Stamp Finder! Send today for big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Patiala, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants enclosing 3c postage. Garcelon Stamp Co., Box 918, Calais, Maine.

YOUR ad in these columns will stick out, get more attention, if you use white space as shown here. Yet the cost is little more. For details, address Classified Ad. Mgr., 11th Floor, 353 Fourth Ave., New York, N. Y.

CANNIBALAND—British Solomon Islands, genuine Baden, Liberian Bongo, fantastic Manchukuo, Cayman Islands beauty, \$5.00 U. S., Bizarre Negri Sembilan, Turks Caicos. Everything 3c with approvals. Viking, 1-P Hanson Place, Brooklyn, N. Y.

MAHATMA Gandhi's native states—Bhopal, Charkhari, Cochin, Gwalior, Hyderabad, Indore, Jaipur, Jhind, Patiala, Travancore. Everything 3c with approvals. Kravat, 19258 Quentin Road, Brooklyn, N. Y.

FREE Stamp Catalogue, 1940 edition—giant fifty-page quarterly listing albums, supplies, Canadians, Newfoundland, United States, foreigners, pictorials. Illustrations Galore! Empire Stamp Co., Dept. PR, Toronto, Canada.

ZOOIE! Lilliputian airport, Perak, Selangor, Weird Afghanistan, Siberia, Palestine, Wurttemberg, bicolored banana Airport, Jungland beauties—3c with approvals! Saxon Company, 408-B Jay St., Brooklyn, N. Y.

50 DIFFERENT, fine U. S. including perforation Gauge, 10c with approvals. The Stamp Shop, 813 Holland Building, St. Louis, Mo.

INTRODUCTORY packet all desirable stamps—triangles, mournings, new issues, obsoletes, airmails—with approval selection, 5c. H. Dickinson, Box 808, Long Beach, Calif.

SACRIFICING 15,000 sets! Many commemoratives, pictorials, airmails, highly catalogued sets included. 40 Different \$1.00; 85 different \$2.00. John Riordan, 1738 Longfellow, Detroit, Mich.

FREE—World's only octagonal (eight-sided) set and 25 different Japanese pictorials to approval applicants. Charles W. Cleaveland, 806 North Humphrey, Oak Park, Ill.

ECUADOR stamps of New York and San Francisco World's Fairs: also 50 different stamps 5c with approvals. Libby Stamp Co., Station P, Box 43, Brooklyn, N. Y.

COLLECTORS. Fine United States airmails, commemoratives, postage on approval. No premiums. Just fine stamps. Harvard Stamp Company, 318 Harvard St., Brookline, Mass.

U. S. 6c 1918 airmail used. catalogue 75c for only 25c. U. S. or foreign approvals with each order. W. C. Phillips, 750 Main St., Hartford, Conn.

ELUSIVE Imperforate triangular miniature sheet with 100 different stamps—10c. Friendly Philatelists, Box 4428P, Philadelphia, Penna.

FREE! Select 10 stamps from our approvals free. Just send names, addresses 2 active collector friends. Ranger Stamp Co., Dallas, Texas.

SIX dollars for 9c! 300 different stamps (Cat. price \$6.00) only 9c with approvals. Tatham Stamp Co., Springfield-50, Mass.

FINE Approvals. Freshly filled books and sheets. Tell me what you want and I will send it. Milton Skinner, 306 East Fourth, Long Beach, Calif.

SEE for yourself! 20 Different commemoratives. Also U.S. packet. Everything 3c with bargain approvals. Dolve, Box 406E, Minneapolis, Minn.

PERU. Special introductory offer. 108 different \$1.00. Mutze, Lima-Peru, AP-1553.

UNPICKED mixture: 40c pound. 100 U. S. revenues on documents, 10c. (700—50c). Vanvoorheis, Hyndman, Penn.

FREE! Wholesale stamp catalog. Westenberg, 10401 East Jefferson, Detroit, Mich.

TEN different United States over 40 years old, 10c. Elzea, Bowling Green, Ohio.

MEXICAN dollar bill and 100 different foreign stamps 10c. Nagles, 346 North 12th, Reading, Penna.

HIGHEST prices paid for stamp collections. Philatelic Headquarters, Trenton, N. J.

33 DIFFERENT United States 5c. Approvals. Utechs, 1143S. North Keeler, Chicago.

APPROVALS that satisfy. Try them. 100 different stamps 10c. Coin. Jayne, 302 Waverly, Syracuse, New York.

U.S. Mint collection being sold. Want lists appreciated. Law, 106 Rockland Street, Swampscott, Mass.

140 CONGO, Sembilan, Palestine, Siam, Bosnia, Paraguay, etc., 10c. Lufbery, Middletown, Conn.

PENNY approvals. Thousands different. Pictorials, commemoratives. Raymax, Box Blythebourne 11-X, Brooklyn, N. Y.

EXCHANGE your duplicate stamps. List, Swappers, dime. Registrar, Box 2166, Denver, Colo.

FREE! Two coronation sets. Postage 3c. Roberts, 312U Shearer Bldg., Baycity, Mich.

APPROVAL bargain basement. Big discounts. State wants. Schiffermuller, Bellerose, N. Y.

NUDE Duchess, Hindenburg Zeppelin, 5c—Approvals. Laurence Shultes, Berne, N. Y.

100 U. S., Commemoratives, imperf., airmails, etc., 1861-1933, 25c. Weston, Box 383, Ponca City, Okla.

50 FREE, Iraq, Iran, etc., Catalogued \$1.00. Album 3c. Bullard, 268D Northampton, Boston, Mass.

\$10.00 STAMP Free to approval applicants. Boote, 309 Greeley, Webster Groves, Mo.

PENNY Approvals that satisfy. Neil Gronberg, Box 5441S., Philadelphia, Pa.

PENNY Approvals that please. Haywood, 395 Adams St., Pomona, Calif.

FREE gift with dollar purchase. Ask list. Jem Stamps, Port Jefferson, N. Y.

150 GOOD mixed foreign stamps, 3c. Elvin Stanton, Niantic, Conn.

FINE U. S. Mission mixture, 3 lbs. \$1.00. Bell Stamps, Box 4, College Point, N. Y.

BRAZIL, 50 different 10c with bargain approvals. Davis, Silver Lake, Ind.

THREE sets for three cent stamp! Jack Reed, Houtzdale, Penna.

300 DIFFERENT 20c; 1000 75c; 2000 \$2.50. Fred Onken, 630 79th St., Brooklyn.

TATTOOING SUPPLIES

TATTOOING. Engraving. Outfits. Illustrated list free. Percy Waters, Anniston, Ala.

TAXIDERM

GLASS eyes. Taxidermists'. Furriers' supplies. Big catalog Free. Elwood Company, 228 Smith Bldg., Omaha, Nebr.

TRAPPERS

TRAP fox or coyote: Bunch system gets the slickest furbearer. Results or no pay. Q. Bunch, Welch, Minn., Box T.

TYPEWRITERS, OFFICE DEVICES

TYPEWRITERS, adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

WANTED—MISCELLANEOUS

CASH for used Scientific instruments, microscopes, cameras, binoculars, etc. Write details. Elman's, 2300-PS VanBuren, Chicago.

WATCHES

WATCH-REPAIRING is steady profitable work. Experts usually in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Company, O-2005 Manhattan Building, Chicago.

WATCHMAKERS' Materials, tools; watches; jewelry. Bought, sold, exchanged. Ben Segal's, Mallers Building, Chicago.

WELDING, SOLDERING

100 AMPERE welding transformer—110 volts—60 cycles. Ready for instant use. Five heats, asbestos insulated, scientifically air cooled. Rigidly fabricated for practical use. \$16.50. Larger sizes available. Transformer Supply Co., Sherry Building, Long Island City, N. Y.

REBUILT Welders. All sizes. Engine or electric drive. No junk. Fully guaranteed. Low prices. Terms. Service Co., 3732 Cedar Ave., Cleveland, Ohio.

GUARANTEED solder for aluminum. Trial sample, 25c coin. Pierman, Box 101, Belmar, N. J.

110-220 VOLT arc welders, helmets, plans, material. Holgerson, Canton, Kansas.

WIND ELECTRIC PLANTS

BUILD electric plant operated by wind. Complete plans and catalog 10c. Welders, fencers, burglar alarms, motors, radios, appliances. Send dime today. LeJay Manufacturing, 423 LeJay Bldg., Minneapolis, Minn.

New Catalog —OF BARGAINS IN MILITARY. Outdoor and Sport Goods, Clothes, Shoes, Boots, Blankets, Tents, Firearms, Boy Scout Supplies, etc. Send 10c for copy to be redeemed on first order.

A AND N SUPPLY CO. 4784 Lester St., Richmond, Va. EST. 1868

Best Poultry Paper 6 BIG ISSUES 10¢

Helps increase Poultry Profits. Send coin or stamps. 50 cents for 3 years or 10 cents for 6 months trial. Agents wanted. American Poultry Journal 554 So. Clark Street Chicago, Illinois

WANTED MEN PAST 40

If you are past 40 and desire extra money we can help to make your full or spare time profitable. Business pleasant and profitable. Operate from your home. Call on merchants, shops, schools, churches, auto, truck and bus owners, farmers, lodges, public institutions, etc. Large manufacturer of approved first-aid fire extinguishers, fire alarms, recharges, etc. Write details about your past experience, etc. Address Fyr-Fyter Company, Dept. 92-50, Dayton, Ohio.

Yes! YOU CAN MAKE BIG MONEY WITH HOOVER UNIFORMS!

Big earnings for ambitious men and women in new uncrowded field with famous nationally-advertized Hoover line of smart, exclusive Uniforms for restaurants, fountains, hotels, taverns, stores, offices, doctors, dentists, etc. Not house-to-house. No experience—no money needed to get into this new, big-income business. Mail postcard now for beautiful new Uniform Style presentation, actual samples and money-making equipment—sent FREE.

HOOVER 251 West 19th Street Dept. AK-18 New York

DON'T BUY—SAVE \$ \$ \$

ON RADIO SETS—PARTS, TUBES, PHONOGRAPH RECORDS—UNTIL YOU HAVE SENT FOR OUR NEW GIANT MONEY-SAVING CATALOGUE.

UNITED RADIO COMPANY, DEPT. Z, NEWARK, N. J.

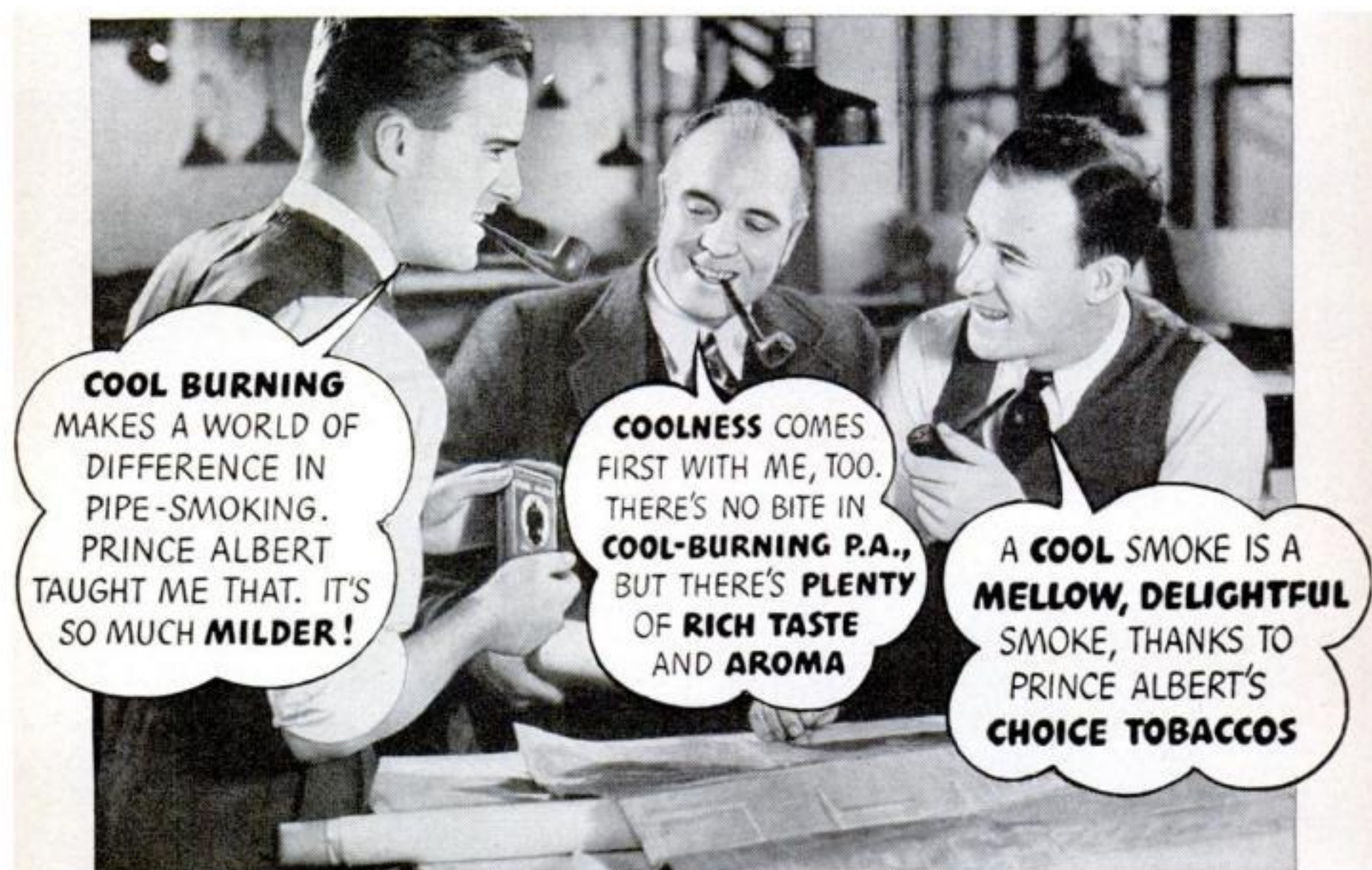
Easy to Play

THE SMALLEST, LIGHTEST, FULL-VOLUMED 90 BASS ACCORDION EVER DESIGNED. IT'S THE NEW SOPRANI AMPLIPHONIC MIDGET

● Think of it! 34 treble, and 90 bass keys, beautiful tone, amazing volume. See and try this wonderful new Soprani at your dealer's, or write for FREE booklet.

SOPRANI, INC. Dept. 231 630 S. Wabash, Chicago, Ill.

“How does **COOLNESS** rate with you in pipe tobacco?” *we asked in a drafting room...*

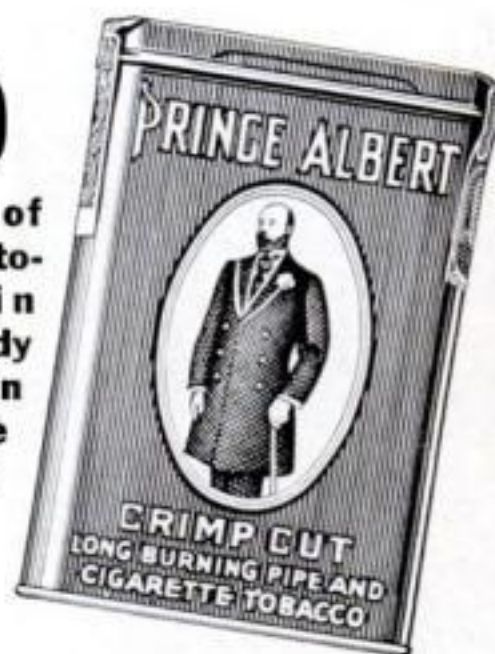


In recent laboratory “smoking bowl” tests, Prince Albert burned

86 DEGREES COOLER
than the average of the 30 other of the
largest-selling brands tested...coolest of all!

UP goes the pleasure of pipe-smoking when burning temperature goes *down!* There's no excess heat to bite the tongue and flatten out flavor and aroma. **COOL-SMOKING** Prince Albert opens the door to **TRUE MILDNESS** and **MELLOWNESS** with **PLEASING TASTE** — the topmost joys of choice tobaccos. “No-bite” treated for *extra* smoothness. “Crimp cut” to pack and draw *easier*. In a pipe (and a “mak-in’s” smoke, too) you’ll simply be delighted with P.A.!

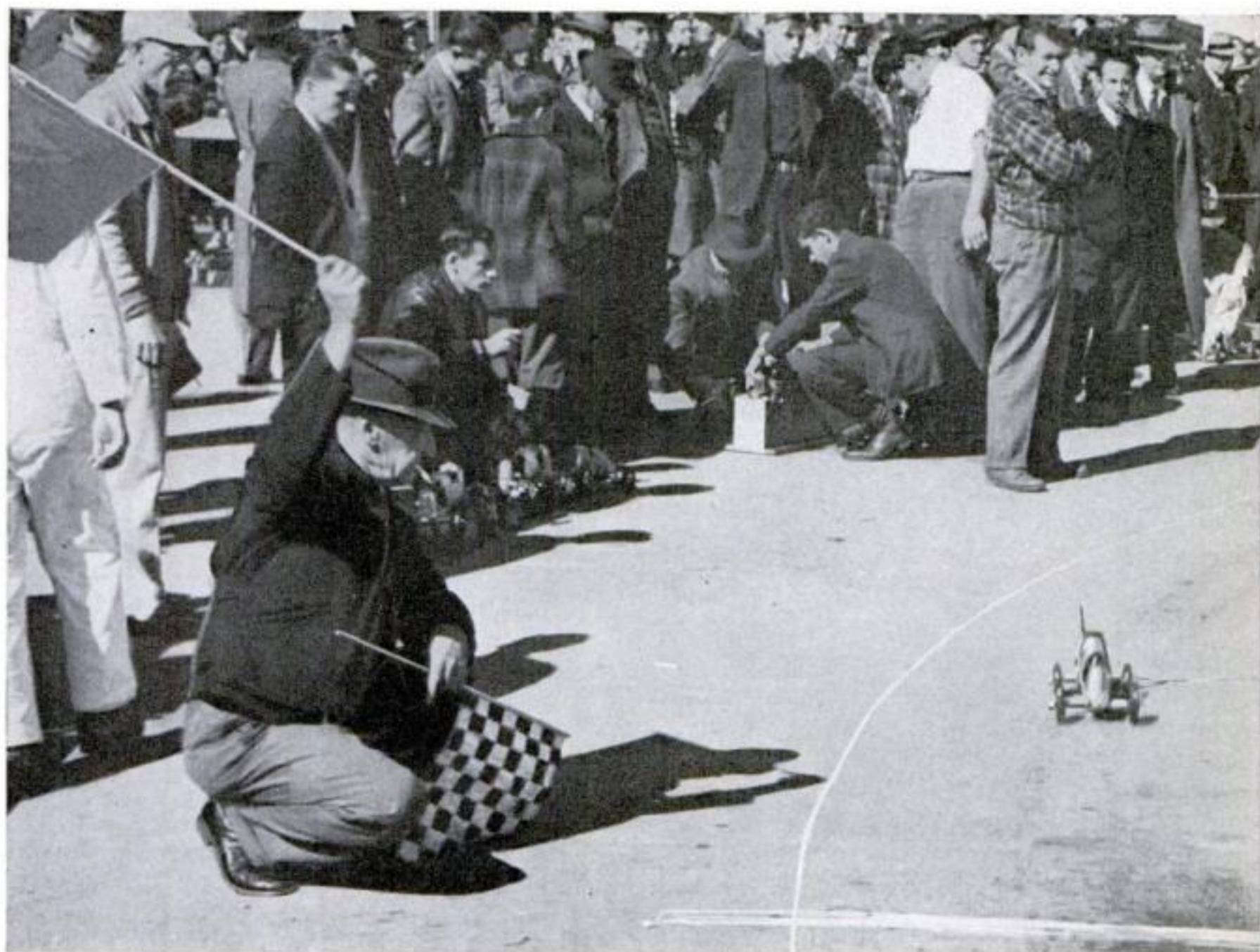
50
pipefuls of
fragrant to-
bacco in
every handy
pocket tin
of Prince
Albert



Prince Albert

Copr., 1939, R. J. Reynolds Tob. Co., Winston-Salem, N. C.

THE NATIONAL JOY SMOKE

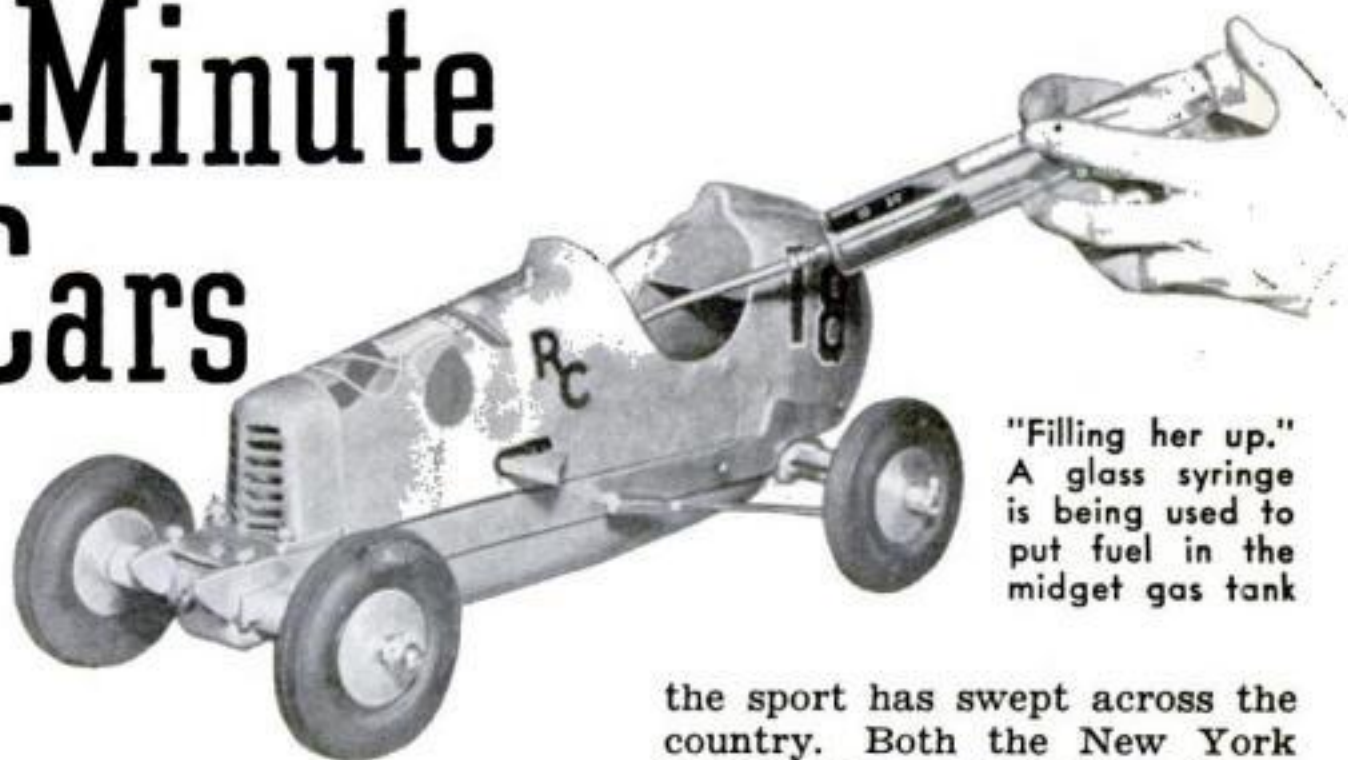


NEWEST RACING CRAZE:

A tiny speedster is flagged as it starts its race against time

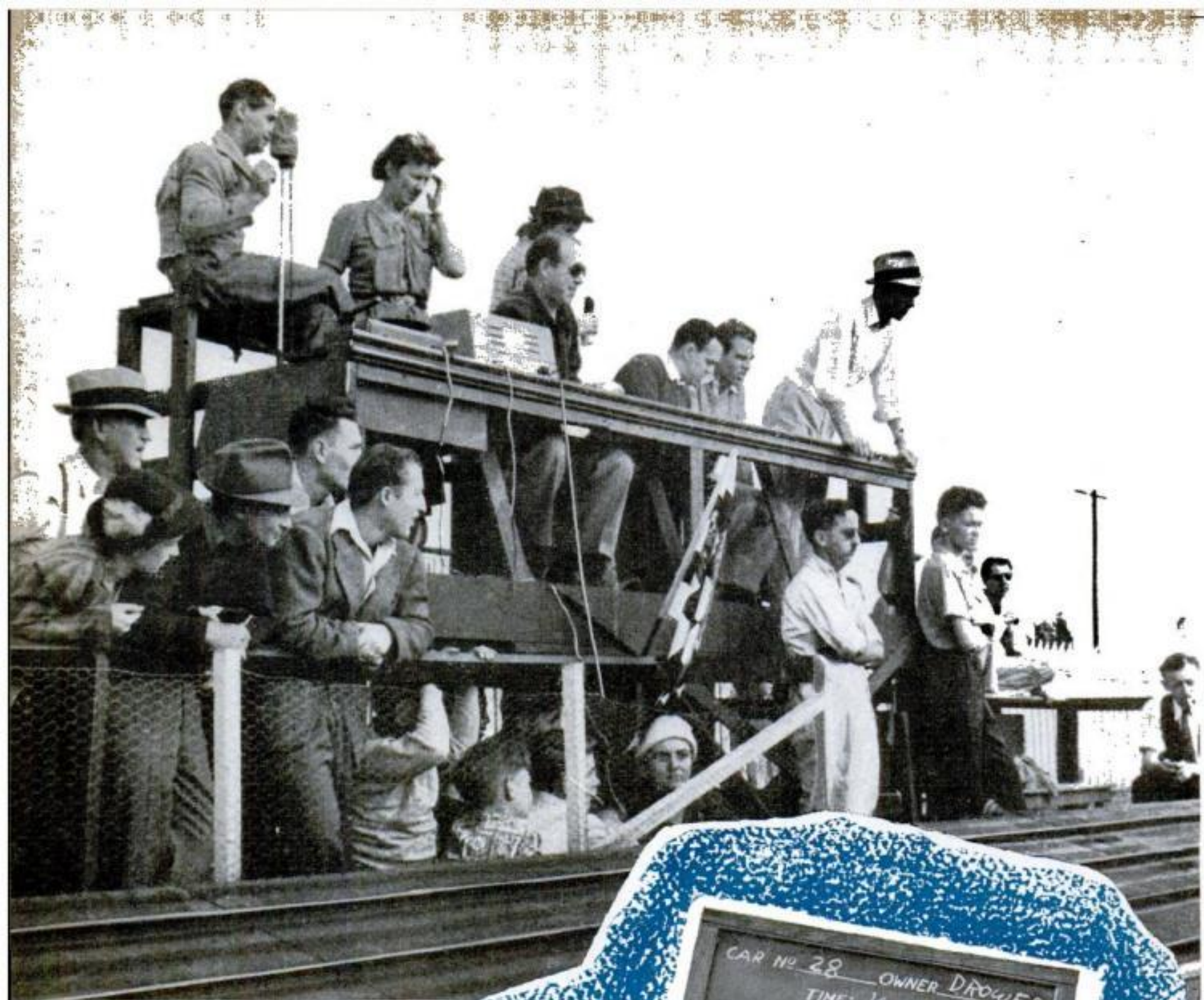
Mile-A-Minute Model Cars

MILE-A-MINUTE midgets, tiny racing cars that whirl at dizzying speeds at the end of wire cables or on special Lilliputian speedways, form the latest thrill sport of model makers. Hardly more than a year ago, the first races were held in California. During the intervening months,



"Filling her up." A glass syringe is being used to put fuel in the midget gas tank

the sport has swept across the country. Both the New York World's Fair and the San Francisco Exposition featured the little machines in races against time. A national association has hundreds of members. Already

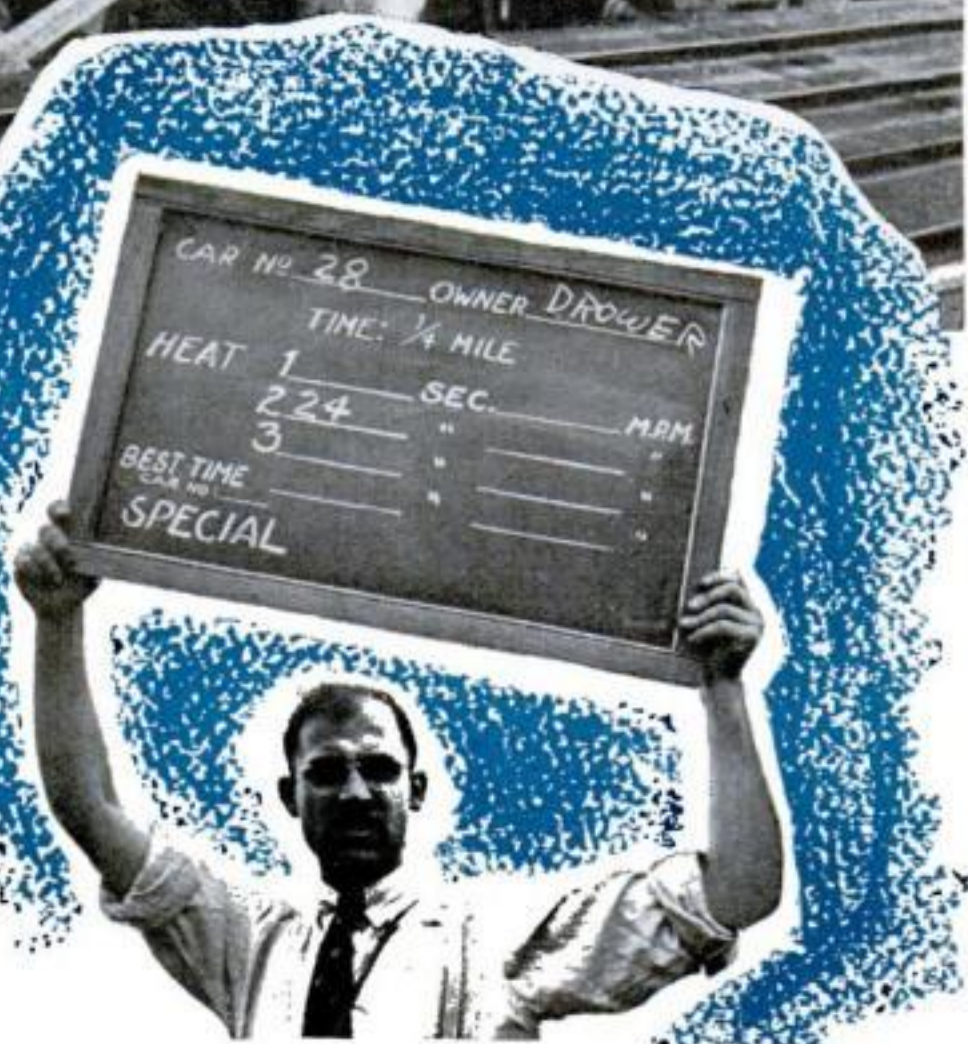


Cars are guided by rails at this model track in Los Angeles, Calif.

miniature speedways are under construction in a number of cities. And manufacturers, in widely separated parts of the country, are making motors and kits for "minicar" races.

Although an engine and ready-to-assemble kit may cost as much as forty-five dollars, it is estimated that there are more than 1,000 enthusiasts active in the country. Flourishing clubs have been formed in Los Angeles, Calif., Pottstown, Pa., Bayside, N.Y., Salinas, Calif., Fresno, Calif., Milwaukee, Wis., and New York, N. Y. How engrossing the new hobby can become was demonstrated recently in a western city when neighbors called the police because a local enthusiast was keeping them awake most of the night tuning up his engine!

It takes but a couple of evenings to put a car together. Then come tests and trial runs, and finally the big moment—the start of a competitive race against time. Such competitions have almost as much action, excitement, color, and noise as a full-sized speedway derby. There is the bawling of loudspeakers, the flash of the starter's flag, the shrill whine of the little engines, the



Model meets have all the fixings, even to electric timers and timing boards

fumes of special fuels, the feverish activity in the repair pits.

One after the other, contestants come to the starting line. Each has three minutes to get his engine started and his car circling at the end of an airplane-cable tether. This cable, the correct length to make six circles of the course equal a quarter of a mile, is attached by means of a roller-skate-wheel pivot to a central post and to the side of the

car by means of a "Y" yoke which snaps into eyebolts on the chassis.

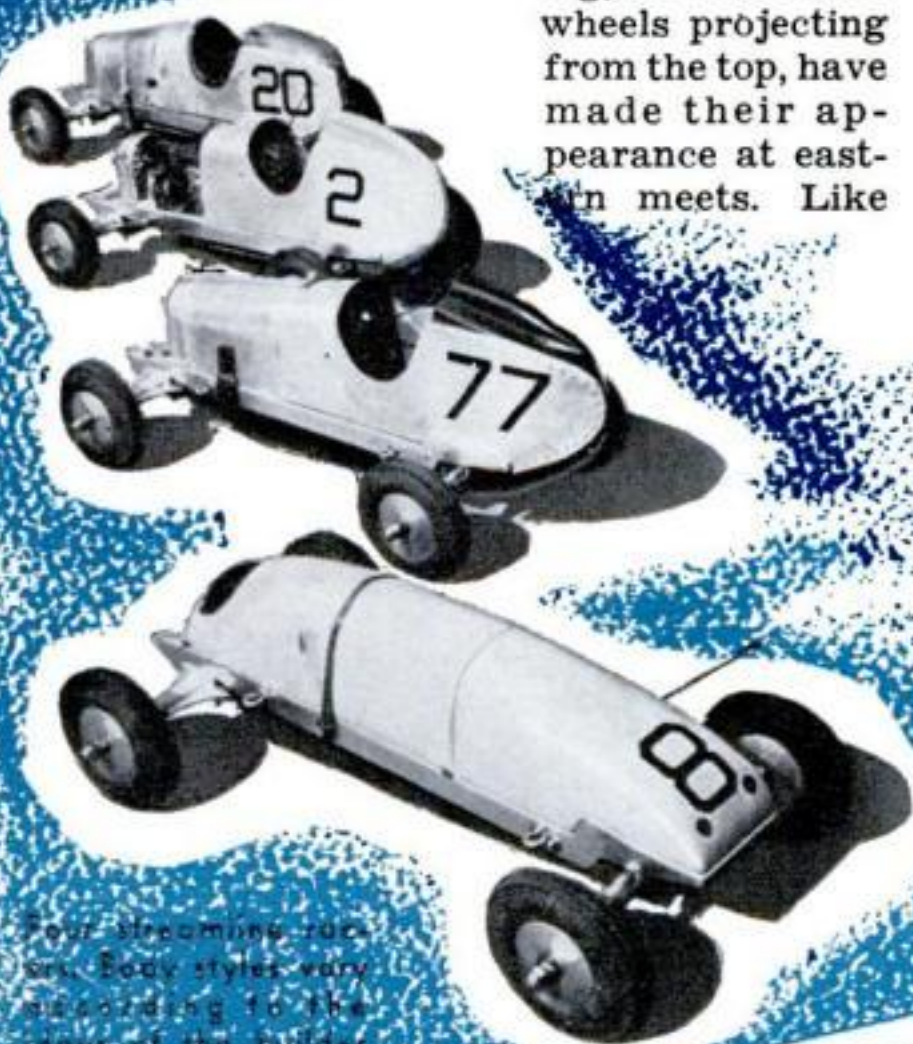
Cranking the air-cooled, model-airplane-type motor is accomplished in various ways. Simplest of all is flipping over the drive wheels. Next comes pressing the flywheel against a spinning tire of an upended bicycle. Finally, electric starters, with whirling, rubber-shod wheels projecting from the top, have made their appearance at east-west meets. Like

infuriated hornets, the little power plants go into action. They often wind up to 10,000 or 12,000 revolutions a minute. The drive wheels, usually turned at a two-to-one ratio, revolve up to 6,000 times a minute, 100 times a second. In fact, so fast do they whirl that you can see centrifugal force increasing the size of the rubber tires as the machines are lowered to the starting line.

With a quick shove, the contestant sends away his foot-and-a-half-long racer. For three laps, it spins at the end of its cable, warming up. Then the starter's flag darts down and the race against time is on.

During the six laps that follow, the unexpected often steps in to add to the excitement. In one recent contest, a tiny streamline car was going at top speed when it struck a bump, flipped over on its back, slid a third of the way around the circle with the wheels spinning in the air, righted itself, and continued the race!

Modern miniature cars are far from fragile toys. The chassis is formed of cast aluminum and the driving gears are of the finest steel. At first, tires from novelty ash trays were used. Now, however, special hol-



Four streamline racers. Body styles vary according to the ideas of the builder.

A roller built into the track at Los Angeles cranks the tiny gasoline motors



low tires, clamped securely to the wheels, are fitted to the racing models. The average weight of the midget cars is six and a half pounds. In competitions, the main rule is that all machines must weigh one pound for every tenth of a cubic centimeter of engine displacement. Not long ago, at an indoor meet at Pottstown, Pa., one car was ruled out as under weight. Undaunted, the owner tied bits of metal and even a flat monkey wrench to the chassis, bringing the weight of his entry up to the required point, and then succeeded in turning in the second best time of the day.

A vital factor in prize winning is getting the carburetor set just right. Early experimenters frequently soldered the carburetors directly to the engines. In speed trials, the power plants heated up and the expanding metal of the carburetor changed the delicate adjustment of the needle. By separating carburetor and motor with a short length of rubber-and-fabric hose, two Bayside, N.Y., enthusiasts, Art Ritter and Jerry Collins, overcame the difficulty. The hose conducts far less heat than metal does.

It was Collins, last summer, who played an important part in the most sensational run of the New York World's Fair competition. A California fan, R. E. Hulse, of Fresno, had sent a sleek racing car by air express for entry in one of the Sunday competitions. Following the detailed instructions which accompanied the machine, Collins sent it away on its speed run. It shot off at such an unexpected pace that it rocked over the center post and more sandbags had

to be piled about its base. Then the little car got away for another flying start and at the end of a quarter of a mile, it was flagged down after having attained a peak speed of fifty-five miles an hour.

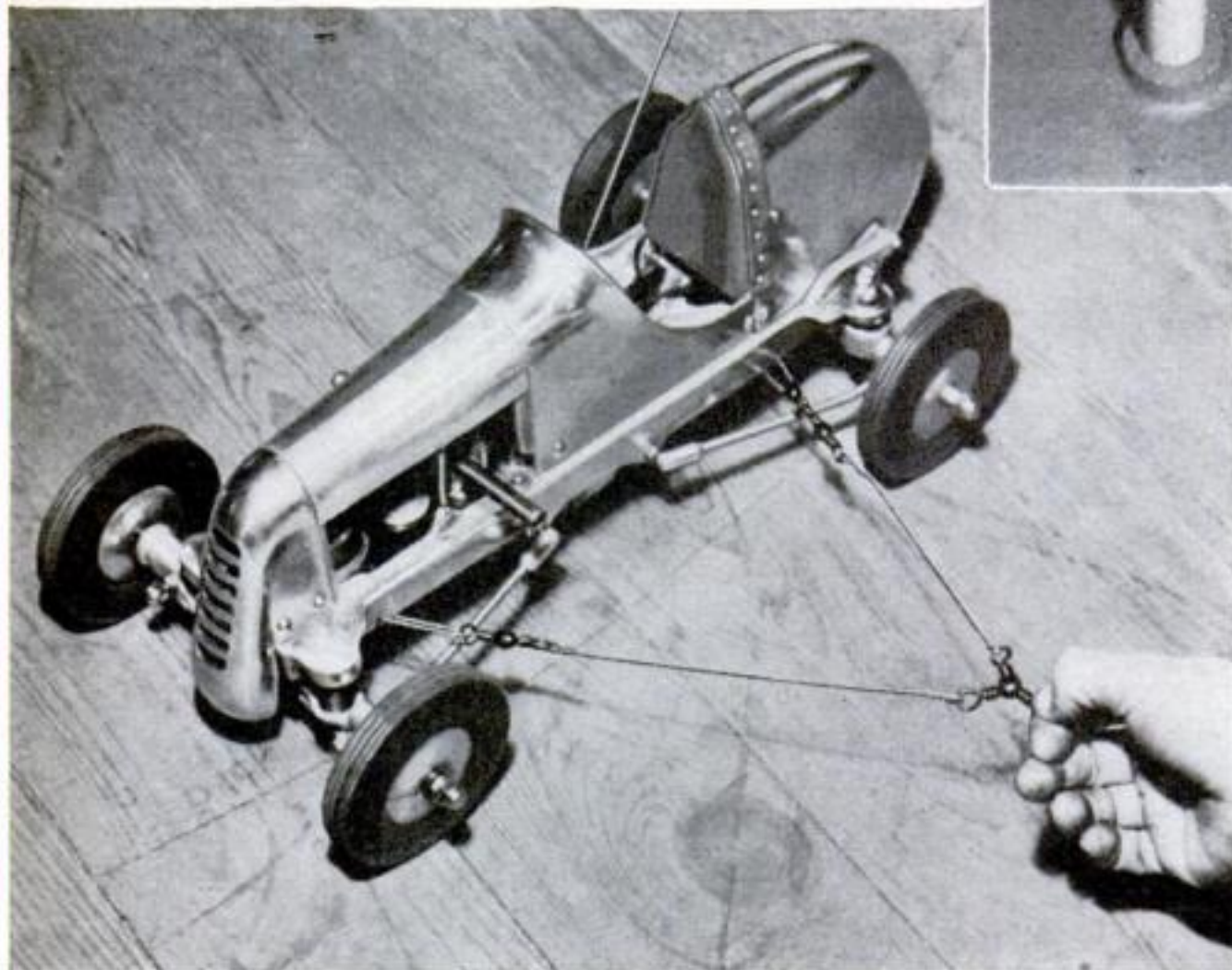
"Flagged" down is technically correct. For the speeding midgets are now usually stopped by means of flags. A stiff wire extends for several inches above the body. When it strikes the cloth of the flag, it is pushed back, flipping off a toggle switch and stopping the engine. This improvement simplifies the work of bringing the whizzing cars to a halt.

Other innovations make their appearance at almost every meet. A few weeks ago, in California, a car equipped with a Lilliputian, belt-driven supercharger, attracted wide attention. To increase the efficiency of his racer, another western enthusiast has developed a centrifugal clutch which grips



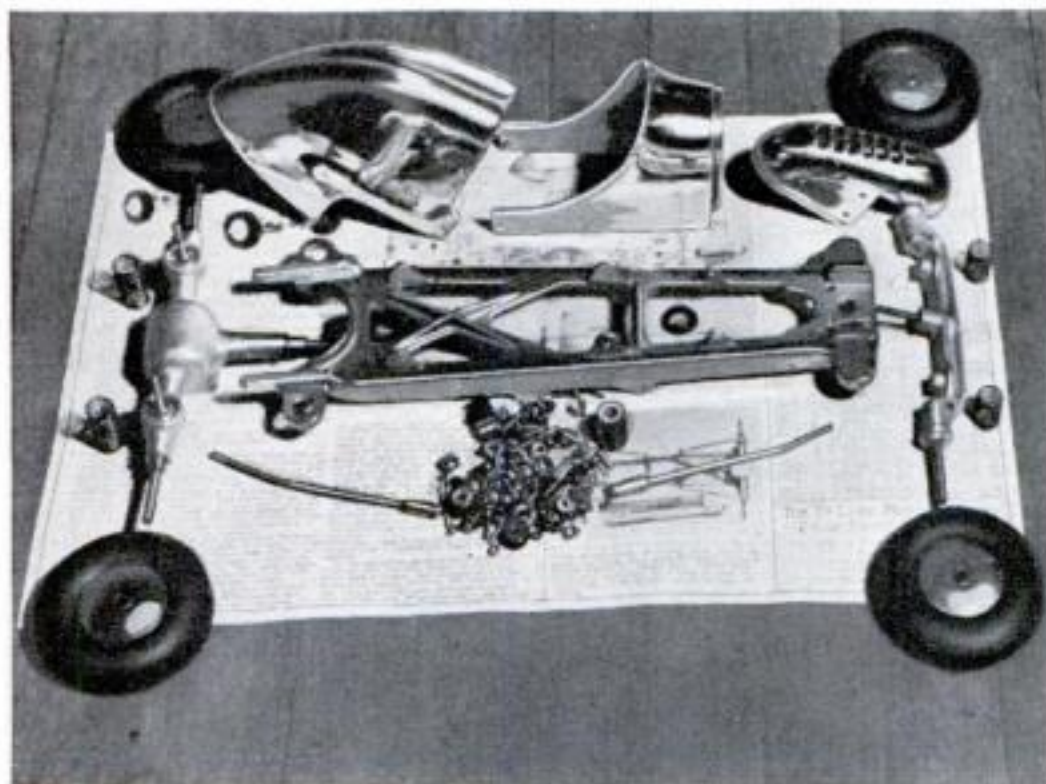
In most races, the car is tethered to a center post by a length of airplane cable

At the car, a "Y" yoke of wire fastens the cable to the side of the aluminum chassis





Spectators watch a contestant warm up his car at a recent race held in New York City



Many racers are assembled from kits like that seen at the left

Little black cases house the cars when owners travel to a contest



tighter as the machine builds up speed.

At Pottstown, Pa., William Beaver has developed an ingeniously simple arrangement which steers his racer and keeps it from "fighting the tether" and wasting power. A spring holds the front wheels turned out, away from the central post, when the car is standing still. In motion, the pull of the cable, acting on an arm, turns the wheels inward, the degree depending upon the speed at which the machine is traveling. Thus, centrifugal force automatically keeps the little car "tracking" correctly throughout a race. In the ordinary machine, the steering wheels are permanently set in one position.

Just as individual ideas appeared in the design of the racing cars, so each pioneer had his own pet blend of fuel. Gasoline, benzine, alcohol, castor oil, and other ingredients went into these concoctions. One experimenter produced such a powerful mixture it blew the top off his engine. Another tried pure alcohol and soon discovered it had eaten holes in the walls of his cylinder. At present,

a blend of fuel and lubricant specially prepared for outboard racing motors is most popular with the midget-car racers.

Because of the initial cost of getting started in the sport, two or more enthusiasts often band together to pool expenses and share the fun. Among the most successful teams of the kind are the Dooling brothers of Los Angeles and the Ritter-Collins team of Bayside. Collins and Ritter have cleaned up most of the prizes in the East, including the three-foot trophy presented at the New York World's Fair, and Tom and Harry Dooling carried off the main prizes at the San Francisco Exposition and the coveted Matthews Trophy for the fastest mile made at the new Los Angeles miniature speedway.

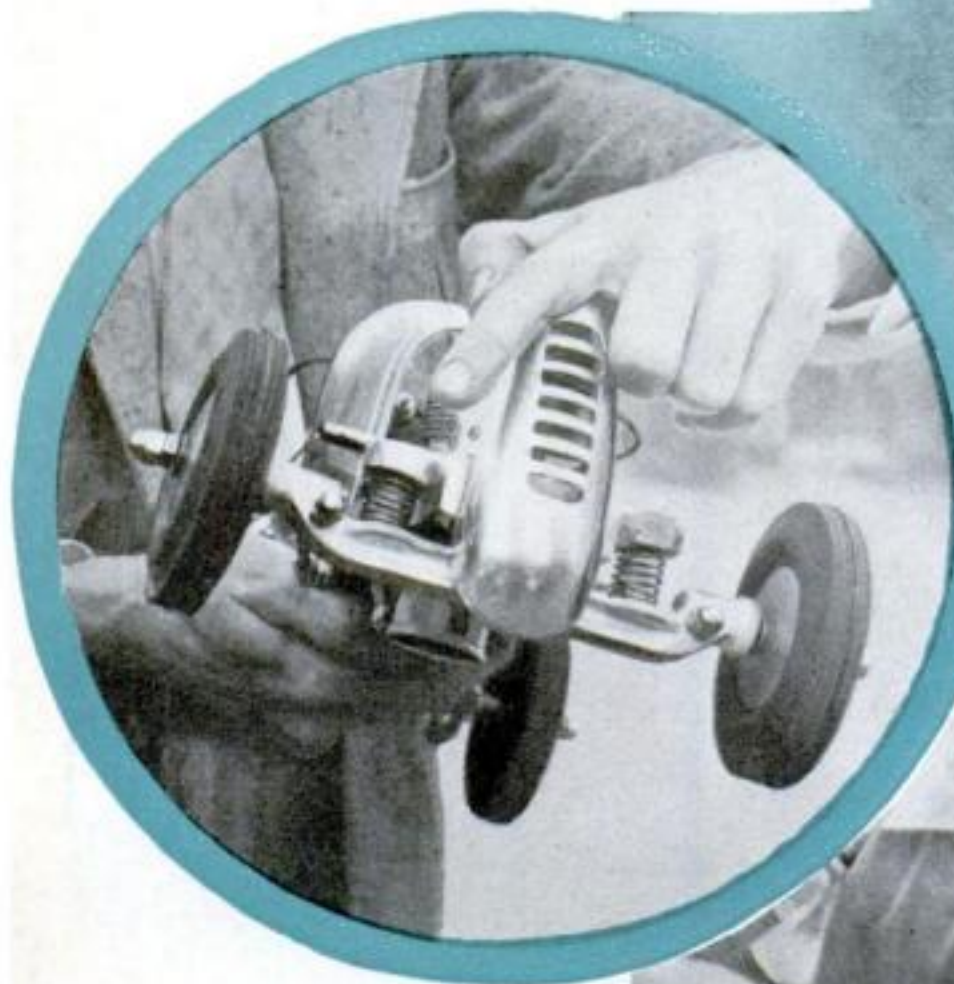
This one-sixteenth-mile de luxe oval represents the last word in tracks for midget racers. There are pits for fifty contestants. The electrical timing apparatus is accurate to a hundredth of a second. A special crash fence protects the spectators, and loudspeakers broadcast the results of the races.

Four machines at a time race around

the banked wooden oval, riding on metal rails much in the manner of cars on a roller coaster. Ball-bearing guide wheels reduce friction so the speed of the cars is cut only two or three miles an hour. Twice, racers at the new track have been timed at better than mile-a-minute speeds.

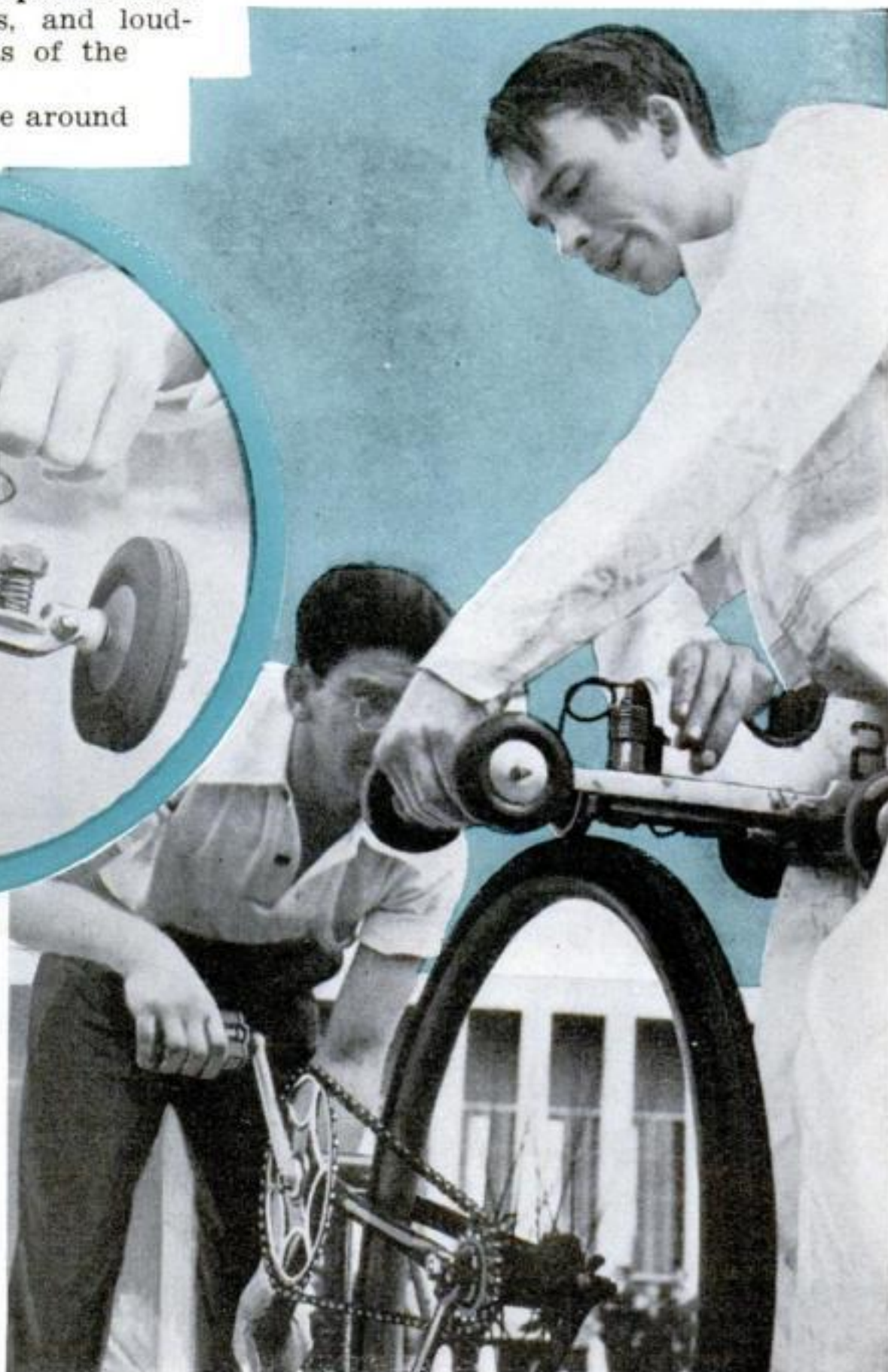
A roller, spinning under the wheels of the cars at the starting line, cranks the engines, and tiny catapults shoot the machines forward at the beginning of the race. Thus, although each car is clocked individually, the four racers are bunched and the excitement is increased for the spectators.

Movie stars and Air Corps pilots, as well as ordinary citizens, have fallen under the spell of the new sport. Growing lists of entries prove the popularity of this craze which combines the fascination of mechanics with the thrills of the roaring road.



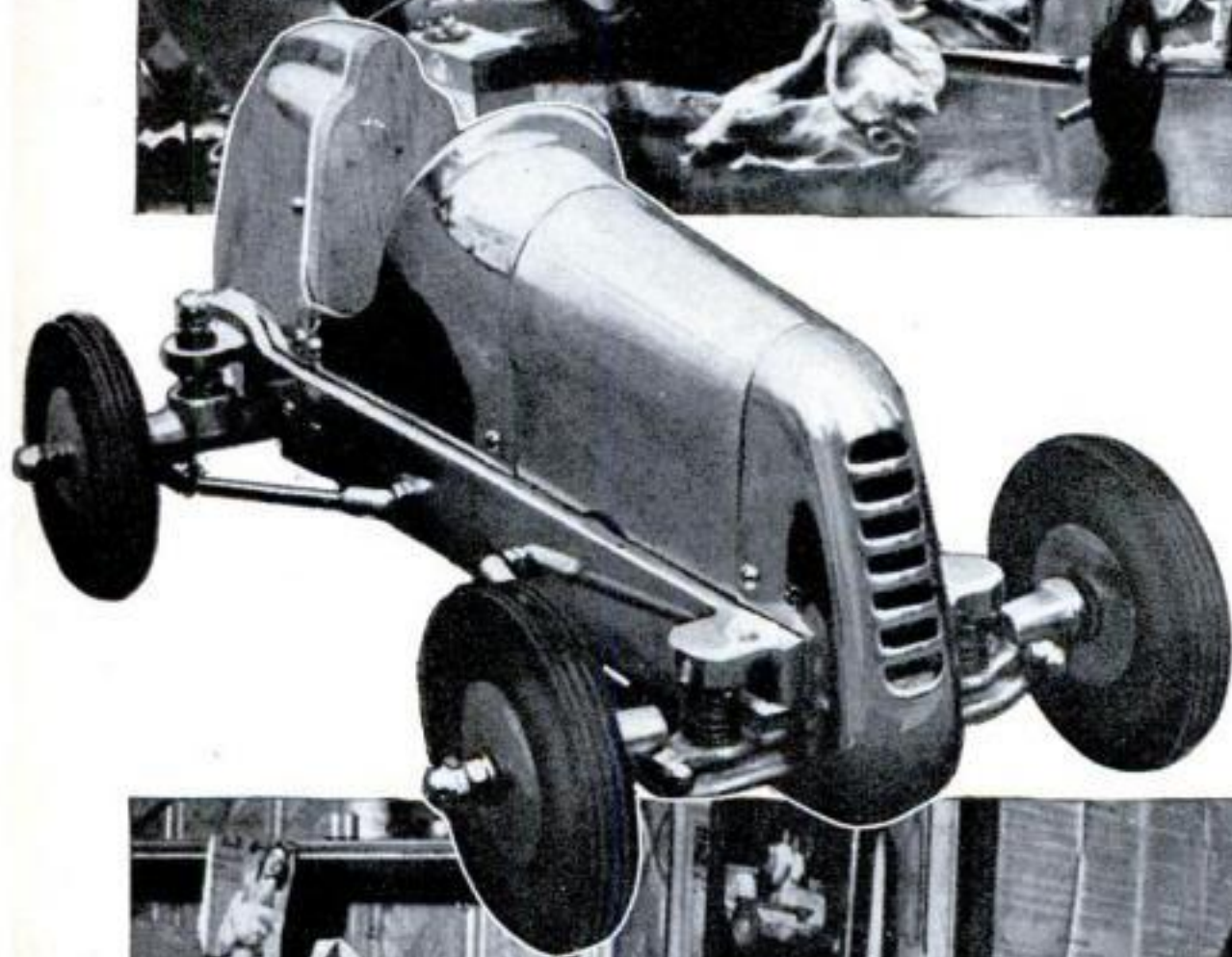
Individually sprung wheels are used on many miniature speedsters to iron out the bumps in rough tracks and help keep the driving wheels on the ground

One way to start the tiny motor is to hold its fly-wheel against the spinning tire of an upended bicycle



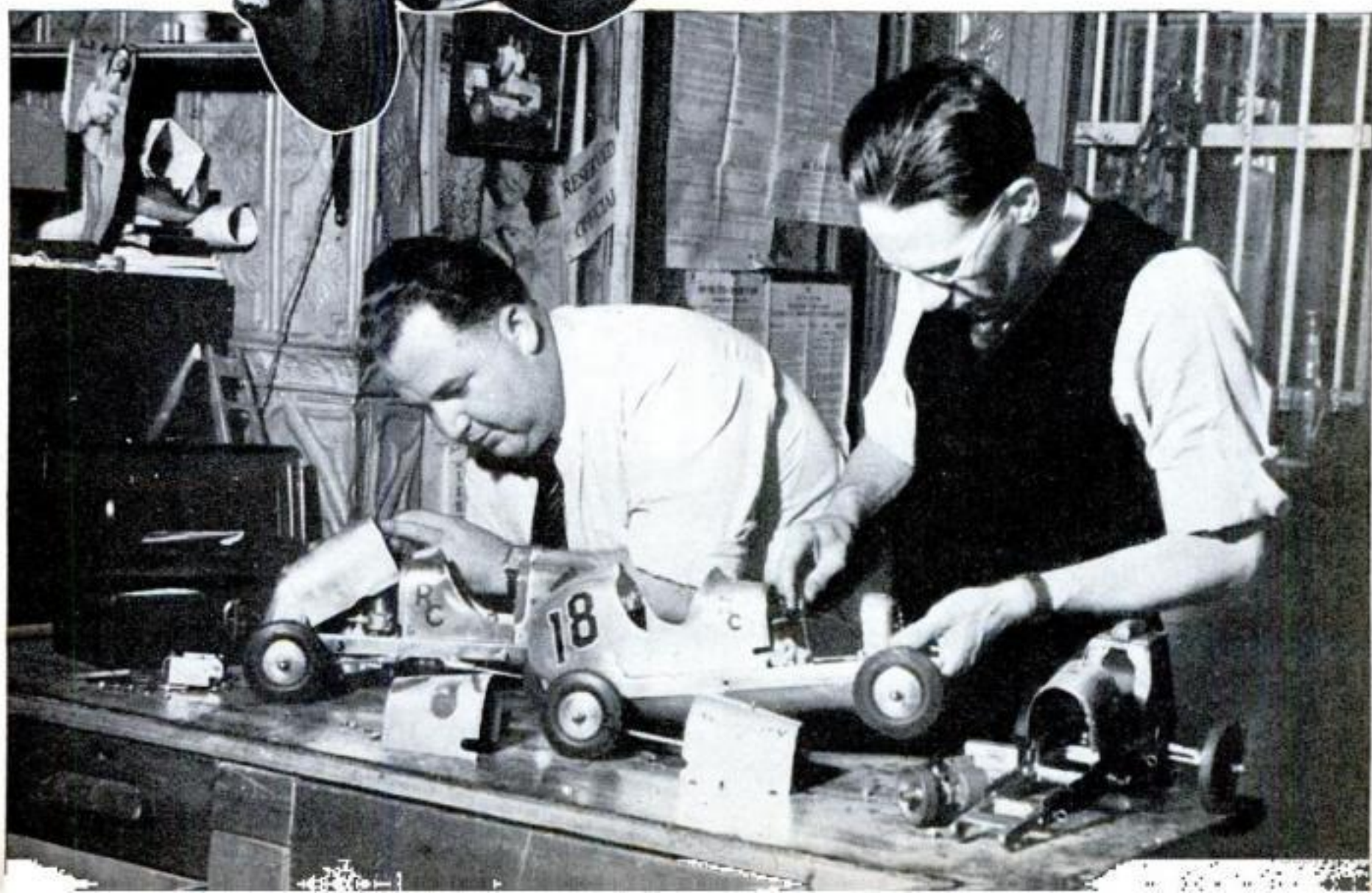


The repair pits where races often are won or lost. Every car must be in tiptop shape when it is placed on the starting line for a speedy dash against the clock



Six and one half pounds of power. A typical model assembled from a ready-to-build kit of parts

Art Ritter and Jerry Collins, a successful team of racers, at work tuning up their cars in their workshop





Two of the positions in which the protective visors can be snapped to the novel ski cap

Three-Way Transparent Visor Is Snapped on Skiing Cap

FITTED to a new ski cap by snap buttons, an adjustable three-way visor of transparent material may be worn either close to the face or over eyeglasses. It also may be fastened out of the way, or detached entirely, when not in use. Tinted and colorless visors, both rimless for full visibility, may be interchanged. Adequate ventilation between the eye shield and the face prevents fogging.

Double Brush Is Shoehorn, Too

A THREE-IN-ONE clothes brush recently placed on the market serves a variety of useful purposes. An auxiliary tuft of extremely stiff bristles provides a means of removing spots from suede shoes. In addition, the handle is so shaped that it may be employed as a shoehorn, as shown below.



Compressed-Air Gun Delivers Concrete

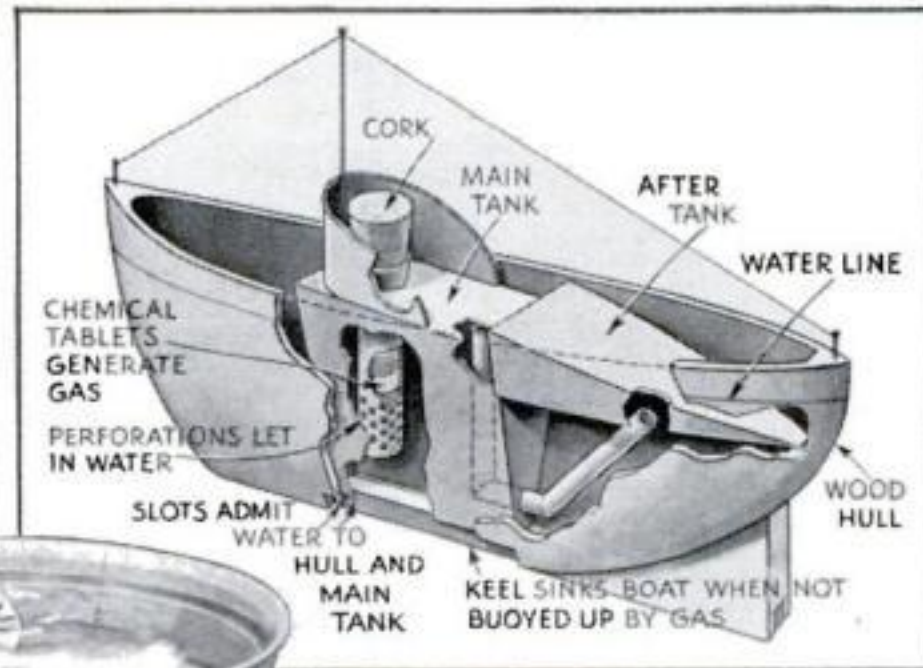
THROUGH a barrel as long as two city blocks, the novel "gun" shown below shoots concrete to line water tunnels at Monrovia, Calif. When a charging box on wheels has been "loaded" with two cubic yards of a fresh mix, an air compressor

builds up 250 pounds pressure to the square inch. The gun "fires" its compressed-air charge every two minutes, driving the load of concrete mix through the length of pipe. By forcing the concrete ahead intermittently, and under high pressure, the mixture is prevented from setting prematurely and clogging the delivery line.



Concrete is "fired" by compressed air from the cylinder through a delivery pipe

Toy Submarine Dives and Rises

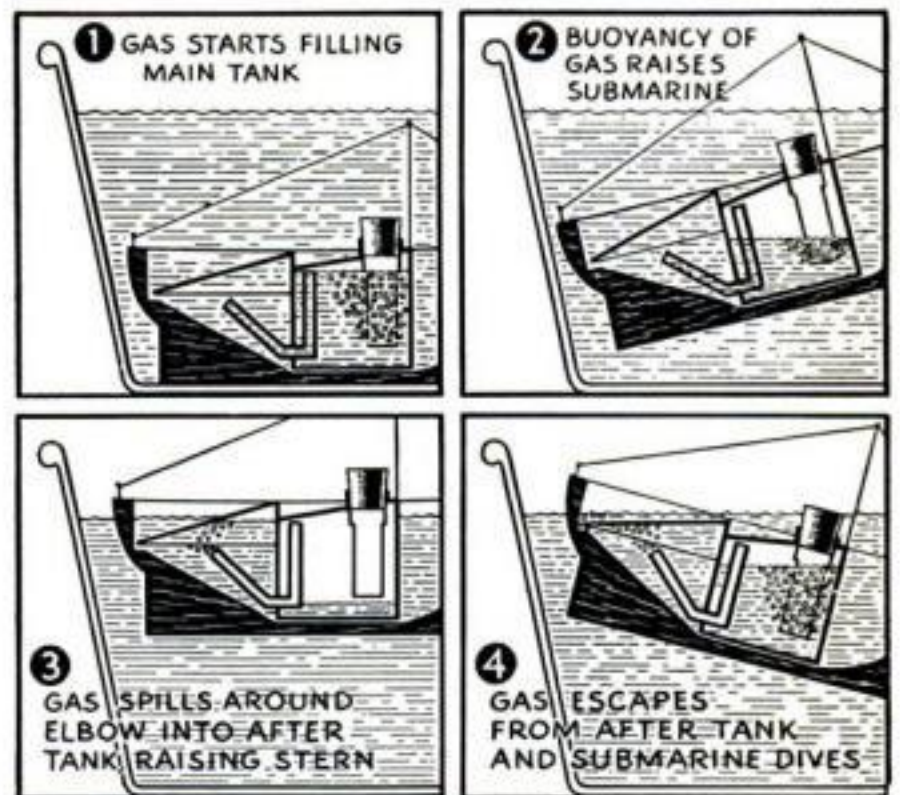


Cut-away drawing of toy submarine, showing gas generator, tanks, and tube

Diagrams below illustrate the way in which the sub rises, levels itself, and dives

The toy operates three minutes on one charge

BY CLEVERLY applying principles of chemistry and physics, a Texas inventor has developed a self-operating toy submarine. Placed in a tubful of water, it repeatedly rises to the surface and dives again, as if controlled by an unseen crew. The secret lies in a tiny gas generator, containing tablets of baking soda and tartaric acid, which react in the presence of water to produce harmless carbon dioxide gas. Buoyancy to raise the toy vessel is provided by this gas, which is shifted through a U-shaped tube between a pair of open-bottomed tanks and then released. The tanks are carefully shaped to "trim" the craft in such a way that it realistically broaches the surface bow first, levels itself on an even fore-and-aft keel, and then disappears stern last. A single charge of



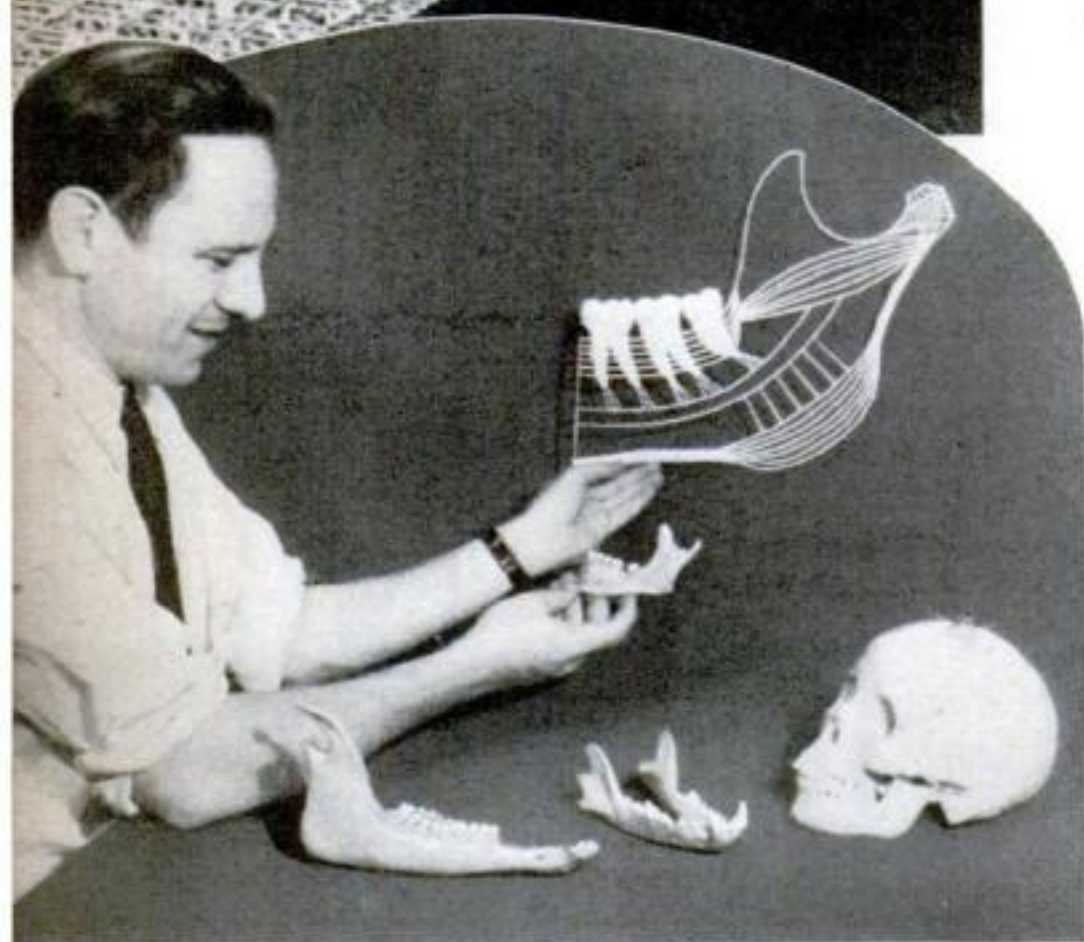
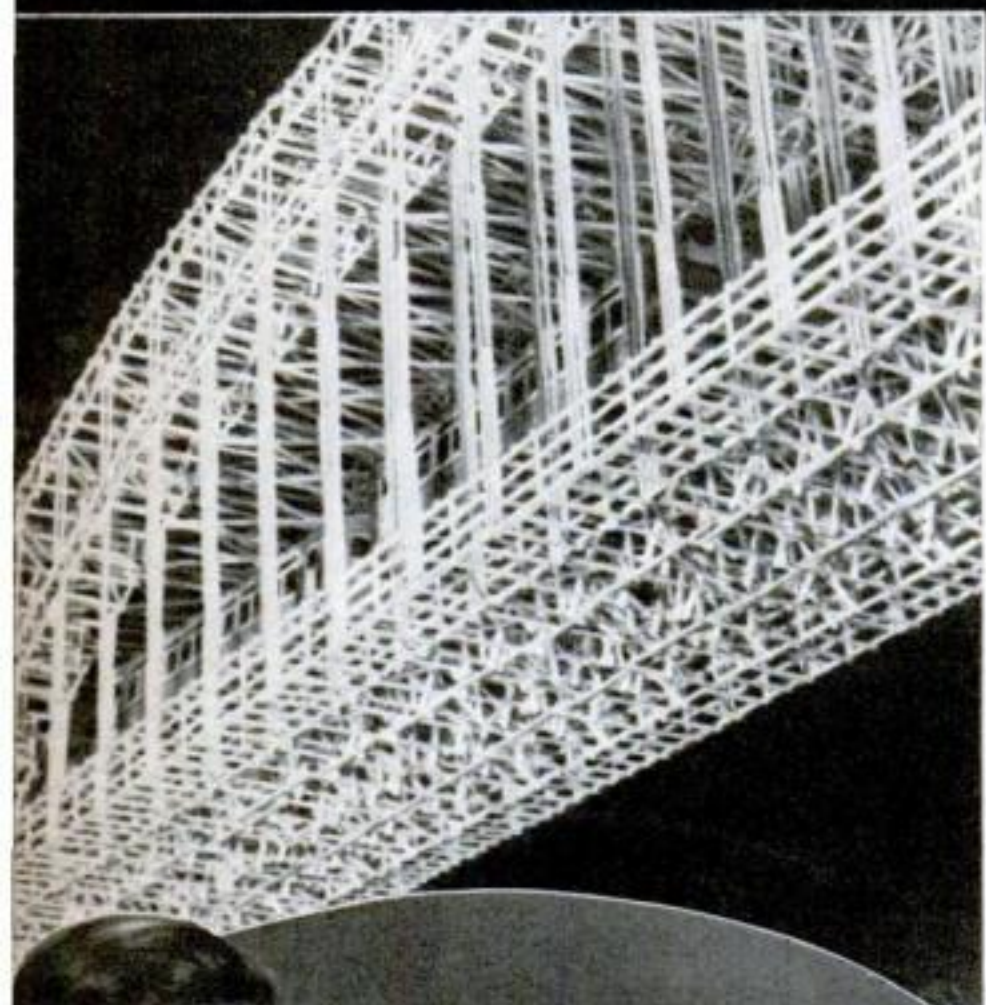
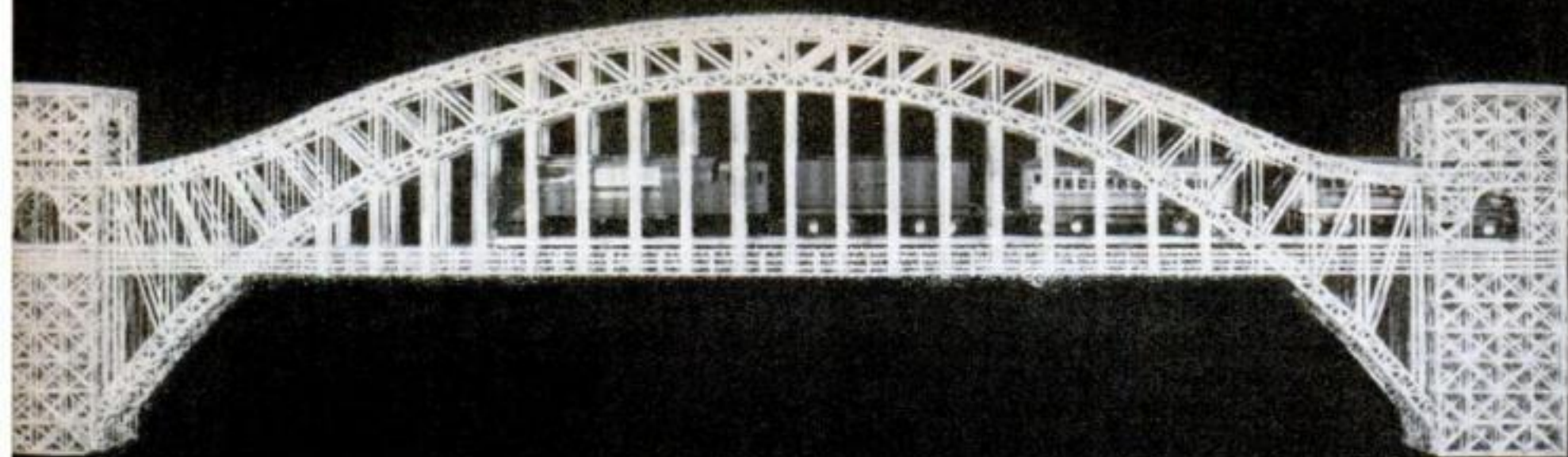
chemicals operates the submarine for about three minutes, during which time it executes eight to ten dives. The gas generator may then easily be refilled with a new charge, and the performance repeated. The inventor suggests that the same principle could be used in a realistic toy whale.



Fireproof Gloves for Camp and Home



BORROWING an idea from industry, department and sporting-goods stores now offer heatproof gloves of asbestos for home and camping use. Fitted with rings for hanging near a fireplace, they save burned fingers in handling flaming logs and hot andirons, and are equally handy around camp fires and barbecues. Two sizes are available.



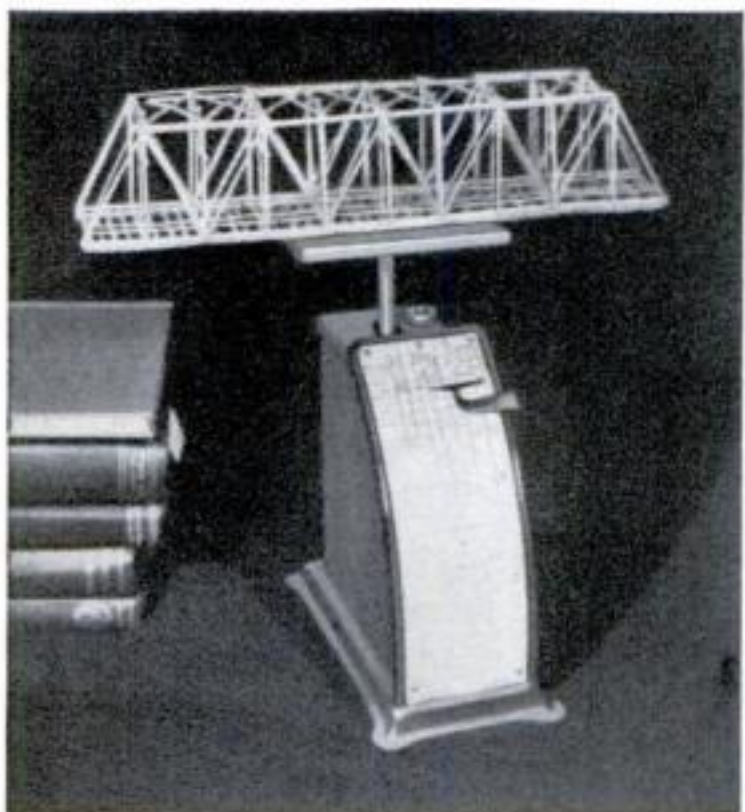
Toothpick Engineering Is Dentist's Hobby

MAKING scale models of giant engineering projects with flat wooden toothpicks and household cement serving as the structural materials, is the unusual spare-time occupation of Dr. M. Russell Stein, a New York City dentist. Ably assisted by his wife, Dr. Stein transforms boxes of toothpicks into architectural masterpieces that are accurate models of their prototypes, practically perfect in every detail.

Twenty-two years ago, as a boy of twelve, this toothpick engineer yearned for a construction set so that he could build bridges and towers as other youngsters were doing. But because it was not his good fortune to own even the simplest of kits, he turned to erecting structures with toothpicks and glue. The completion of his first effort, a model of the famous Eiffel Tower in Paris, France, sent him off to bed filled with pride. But the night was exces-

With a toothpick model, Dr. M. Russell Stein illustrates the structural design of the human jawbone. Above are two views of his model of an arch bridge. Fifty-two inches long, it contains 31,000 toothpicks

By
FRANK CAPORAEI



Although it tips the scales at less than half an ounce, this ten-inch truss span can support a flatiron weighing six pounds. Some of the structures built by Dr. Stein can sustain 500 times their own weight

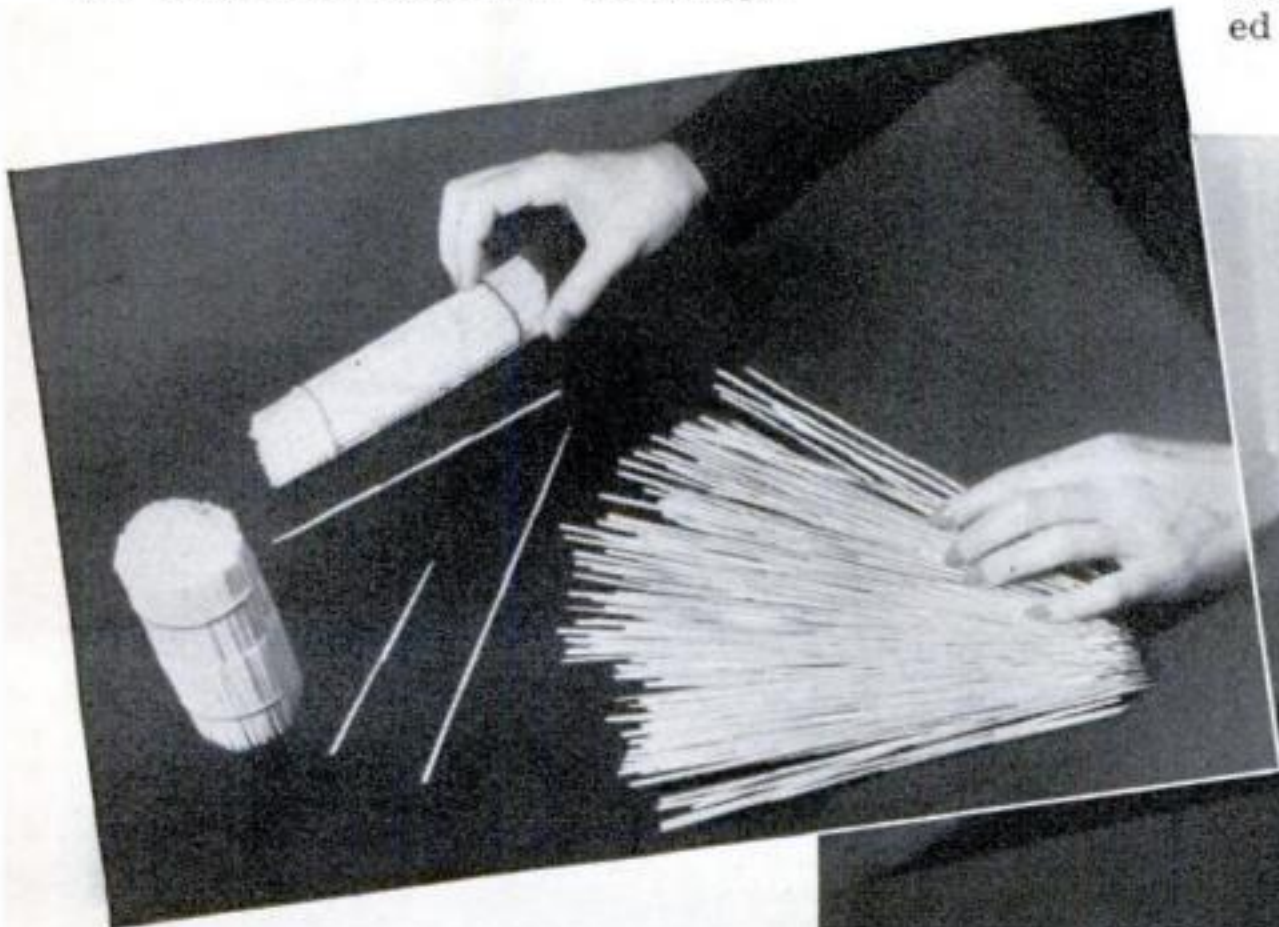
The hobbyist examining details of one of his truss bridges. Its materials cost only a few cents



sively warm and morning found his model nothing but a tangled mass of sticks. The heat had melted the glue.

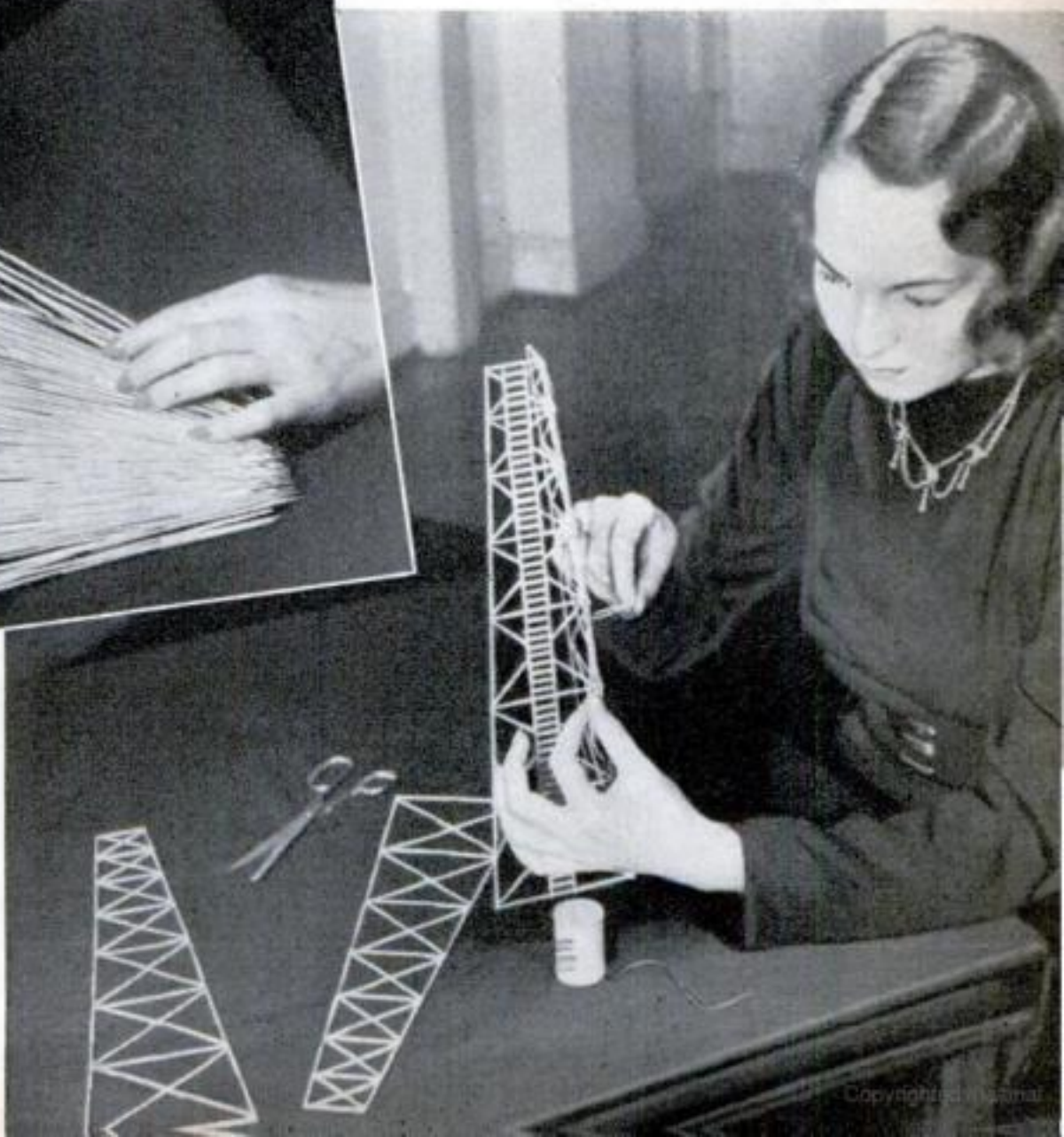
Undeterred by this tragedy, the lad began to experiment with various materials until he found just the right combination of flat toothpicks and household cement. Today he still uses the same simple materials, but his present intricate projects are far beyond his wildest boyhood dreams.

Take his working model of a giant Ferris wheel. This required one and a half months to build, and 27,000 toothpicks went into its construction. Each of its twenty-four cars swings on a pivot to maintain a horizontal position as the main wheel revolves. An accurately constructed gear arrangement drives the



THESE ARE THE TINY GIRDERS

To speed construction, toothpicks are cemented together in advance in lengths of two, three, and four. At the right, Mrs. Stein is joining two flat sections





Ferris wheel on a dowel-rod shaft that employs a collar button as a main supporting bearing.

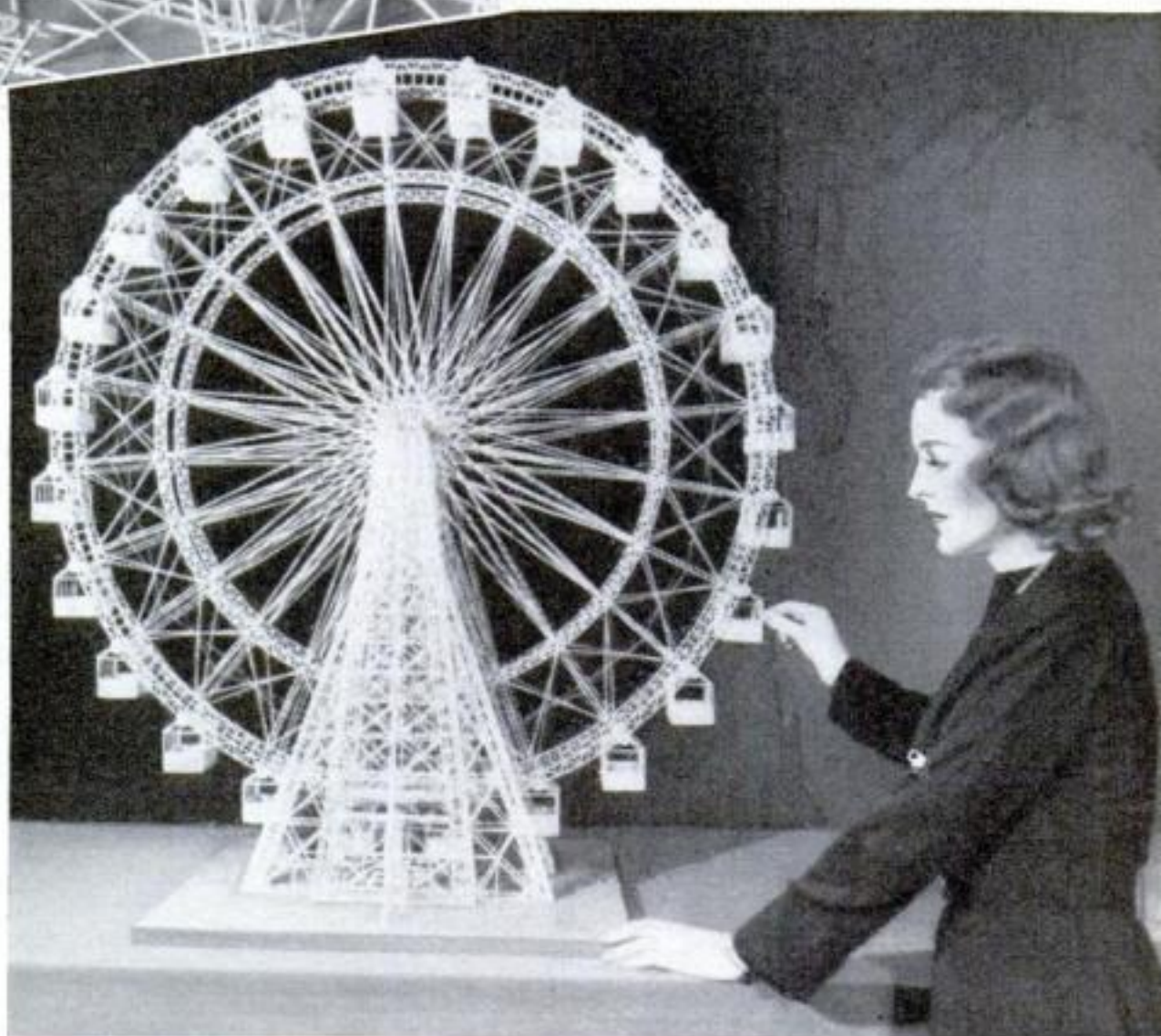
Dr. Stein usually begins his projects by laying them out on paper. Each section is designed and then made in a single flat plane, by placing the toothpicks along the lines of the drawing and then cementing them together. To speed the work, toothpicks are cemented together in advance, in lengths of two, three, and four. Small cutting pliers are the only tool used. When all the flat planes are complete, they are tied together with string and cemented in

place. In addition to its entertainment value, Dr. Stein says that his hobby helps him in mastering problems in dentistry, and in his work as a lecturer on anthropology.

Despite their lacy, delicate appearance, the toothpick models have astounding strength. A small bridge, for instance, that tips the scales at less than half an ounce will safely support a flatiron weighing six pounds, 192 times its own weight.

At the top of the page, the toothpick engineer is seen at work at his drawing board, laying out his newest project

It took a month and a half to build the working model of a Ferris wheel shown at right. The cars keep a horizontal position as the wheel turns, driven by the toothpick gear seen in the photograph above

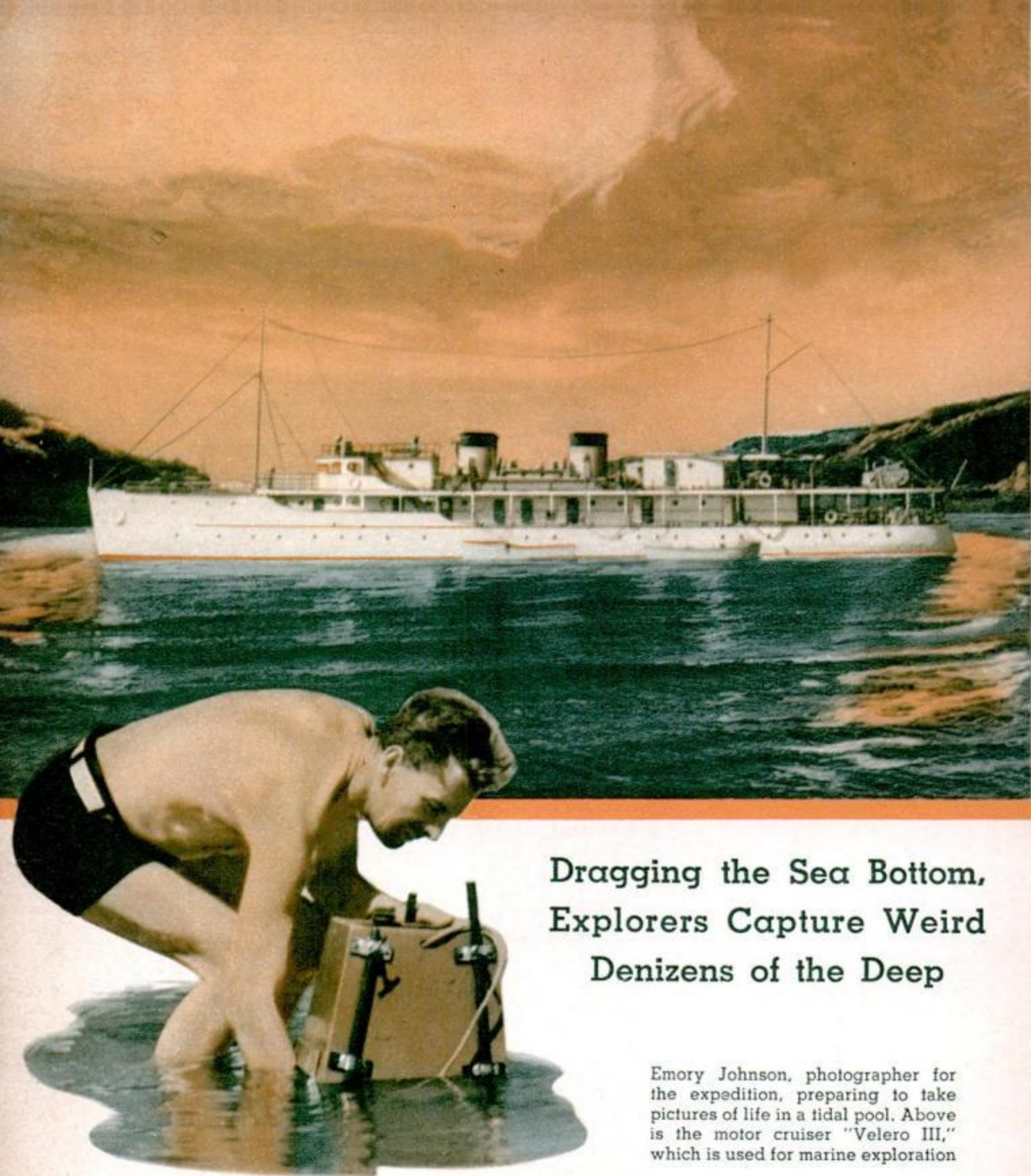




Strange Creatures from the Ocean Jungles



Two freaks from Davy Jones's side show; the
mantis shrimp and, in circle, a basket star



Dragging the Sea Bottom, Explorers Capture Weird Denizens of the Deep

Emory Johnson, photographer for the expedition, preparing to take pictures of life in a tidal pool. Above is the motor cruiser "Velero III," which is used for marine exploration

DREDGING from a small motor launch for sea life in the Gulf of California recently, L. M. Paquette brought to the surface eighteen tiny apartment houses. Each consisted of a hinged yellow shell, the top shaped like a dome, the floor flat as a pancake. Sharing these strange homes, he found tiny crabs and pectens, or scallops. The shell protects both, and the crabs consume food cast off by the pectens. What the crab does to pay for its food and

lodging if anything at all, no one knows.

The pecten apartments are only one of many freaks of nature brought up from the sea's floor by scientists accompanying the Allan Hancock Expeditions during the last nine years. More than 1,000 stations have been established by *Velero III*, twin-diesel cruiser presented not long ago by Capt. G. Allan Hancock to the University of Southern California for marine exploration. From her five small boats, scientists have investigated

By **ARTHUR
A. STUART**

offshore islands and dredged the sea bottom many times.

Praying shrimp, fish without tails, sea cakes resembling glorified sugar cookies, sea urchins whose feet look like burned sparklers, eggs big as your hand, crabs covered by hundreds of barnacles, puffer fish and butterfly flying fish—these head the list of strange animals and plant life captured by the roving researchers.

Although no monsters have been taken, some of the finds present weird and grotesque appearances. Perhaps the most startling, when viewed under an enlarging lens, is the mantis shrimp, captured in Mexican waters. This creature measures a scant six inches from the tip of its claws to its stubby tail. Its head looks like the sea twin of the insect praying mantis. Large enough to be eaten, the mantis shrimp carries two pairs of antennæ, one projecting directly ahead between the claws, the other outward at an angle of forty-five degrees from the top of the head. How do they behave in the sea? "We have no way

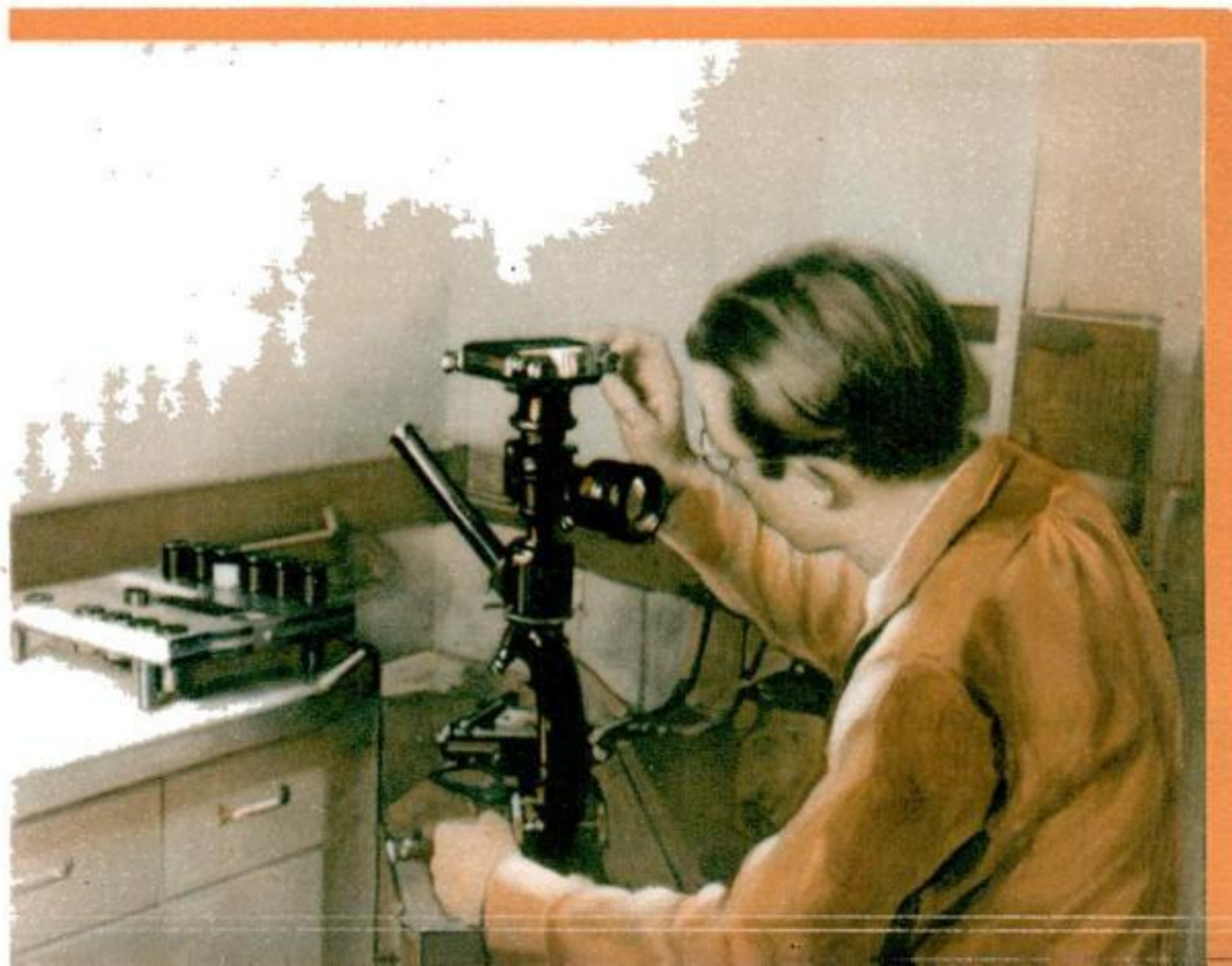


Hunting sand dollars, a variety of sea urchin, in the haul from a dredge

to observe their habits," said John S. Garth, University of Southern California zoölogist and supervisor of scientific work aboard *Velero III*. "We can only collect them infrequently, and wonder."

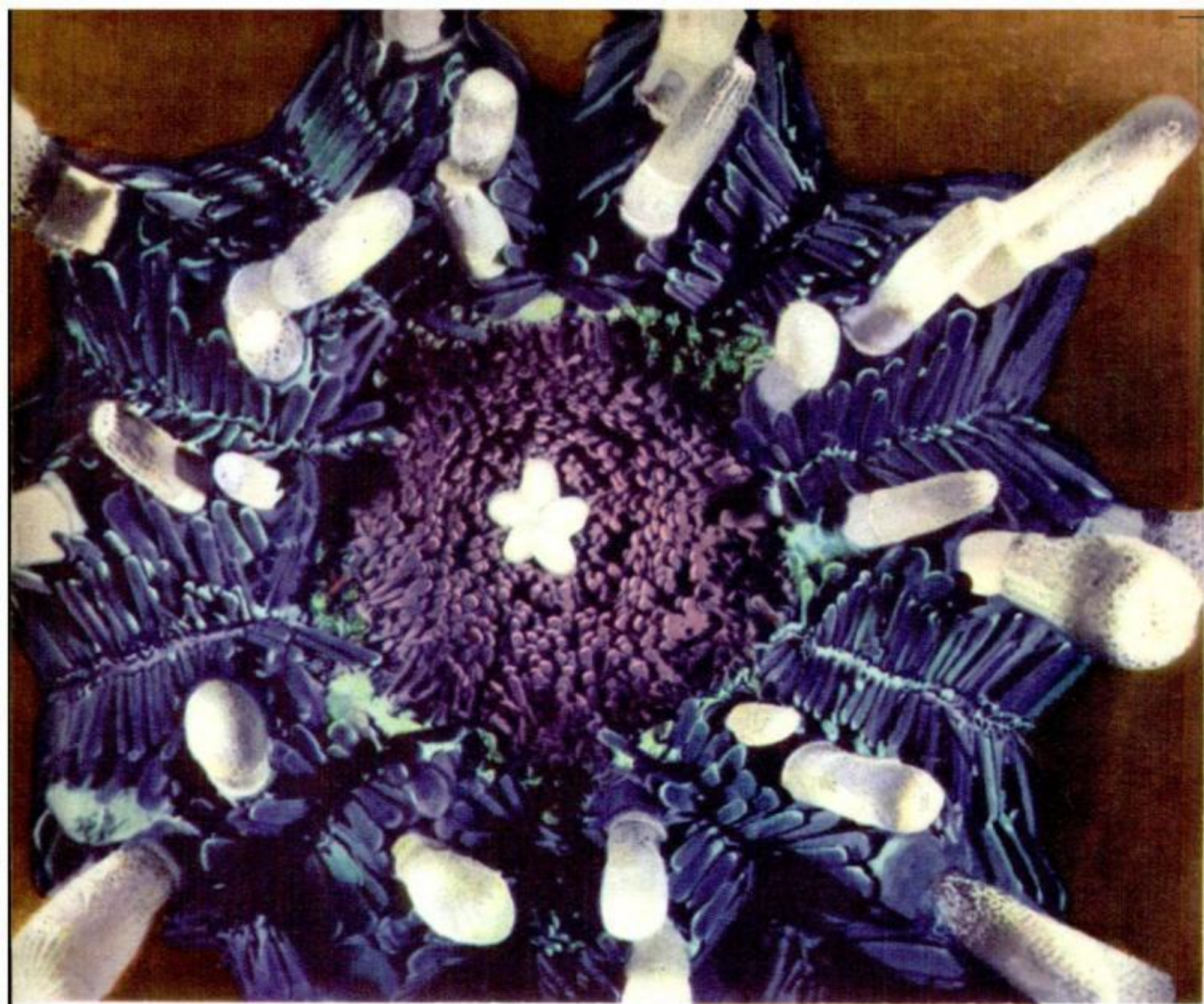
Typical dredged fish is the flounder, yet this fellow is vastly different from flounders captured near the surface. It possesses no finny tail. Caught up usually when the dredge is pulled over a sandy bottom down to about thirty fathoms, its fin is continuous from head to tail and back to head again.

Related, though different as night and



**CAPTURING
SPECIMENS
ON FILM**

Tiny organisms hauled from the ocean's depths are recorded by the microscope



This clubfooted sea urchin was found at the Galapagos Islands. Observe its queer, stubby feet



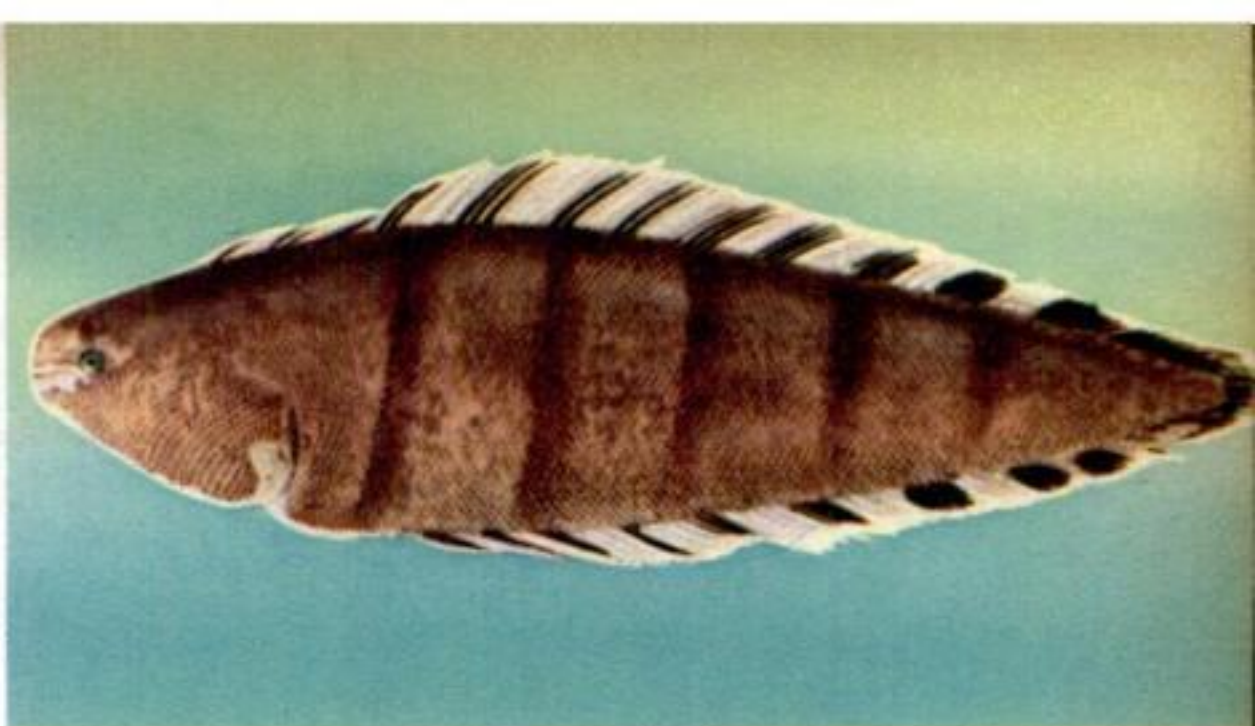
Head of the mantis shrimp. It boasts two pairs of antennae, in front and at sides

day, the flattened sea cakes and the clubfooted "baskets that walk upside down" are both sea urchins. The round cakes, which also are called sand dollars, look almost good enough to eat; while the latter, found near the Galapagos Islands, off the coast of Ecuador, contains a mouth and five teeth which look like a five-pointed star when closed. Its clubfeet resemble burned Fourth of July sparklers or burned cigarettes. All its outer parts seen in the picture on page 76 are scales modified by nature to perform special functions.

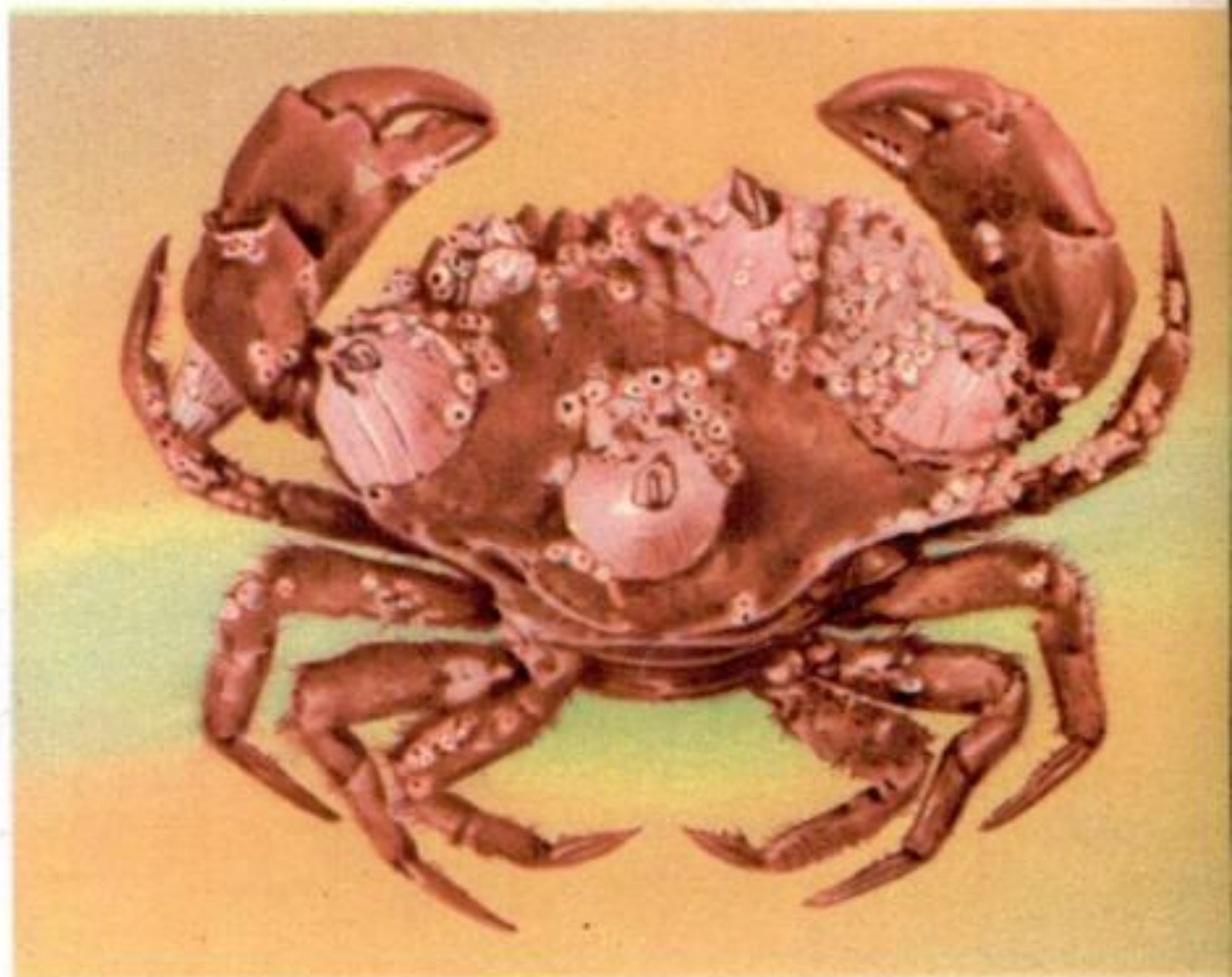
Captain Hancock, master of *Velero III* and always in command when the cruiser sails, never knows what strange creature may be added to the growing collection. From widely separated areas two unusual specimens were taken recently.

While peering through a water glass into a tidal pool on the Galapagos, preparing to photograph several underwater plants, one of the expedition cameramen saw a strange four-pronged black object float into view.

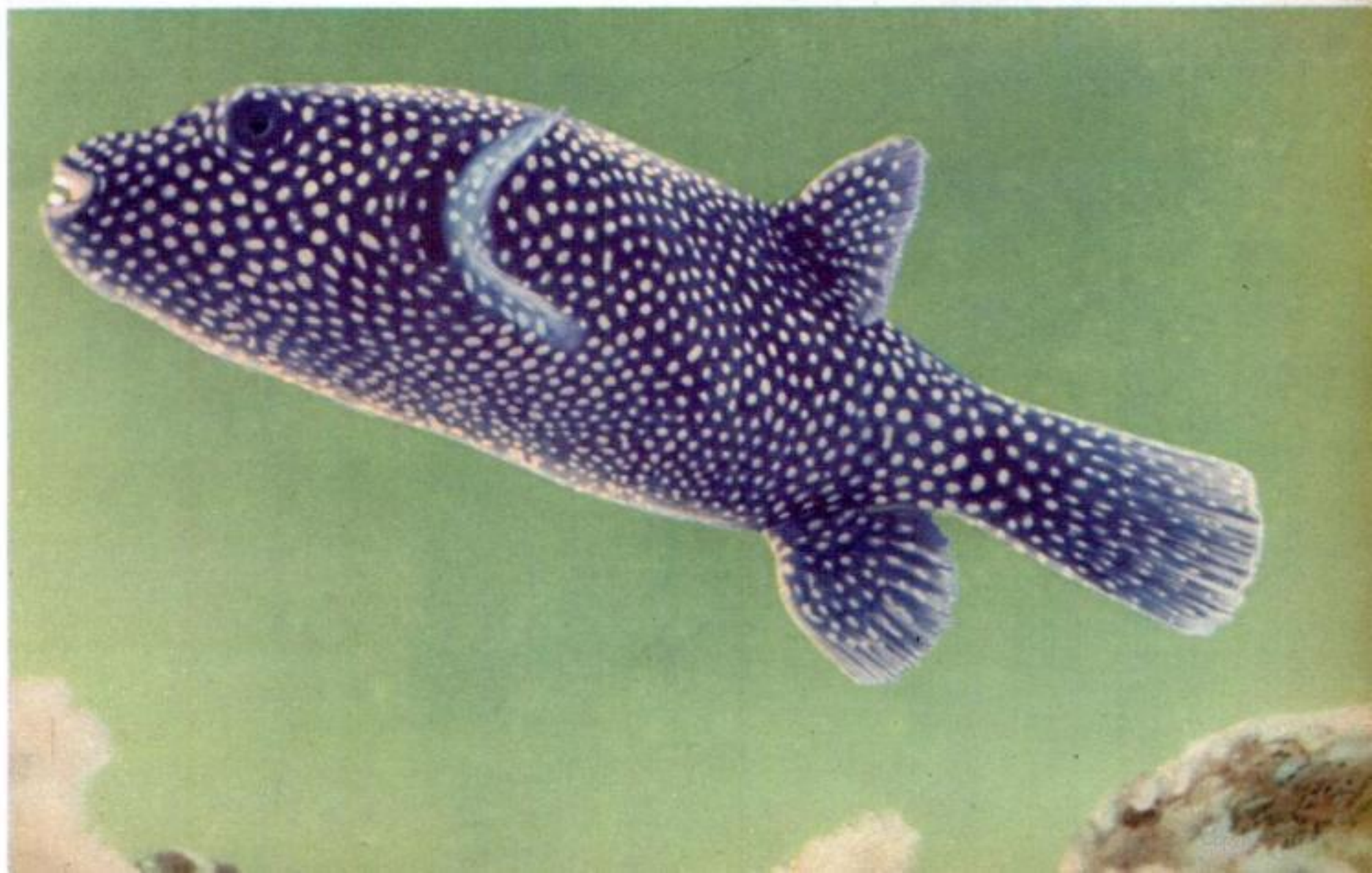
When danger threatens, the spotted puffer blows himself up too big to swallow



Caught on the sea floor, this flounder has no separate tail

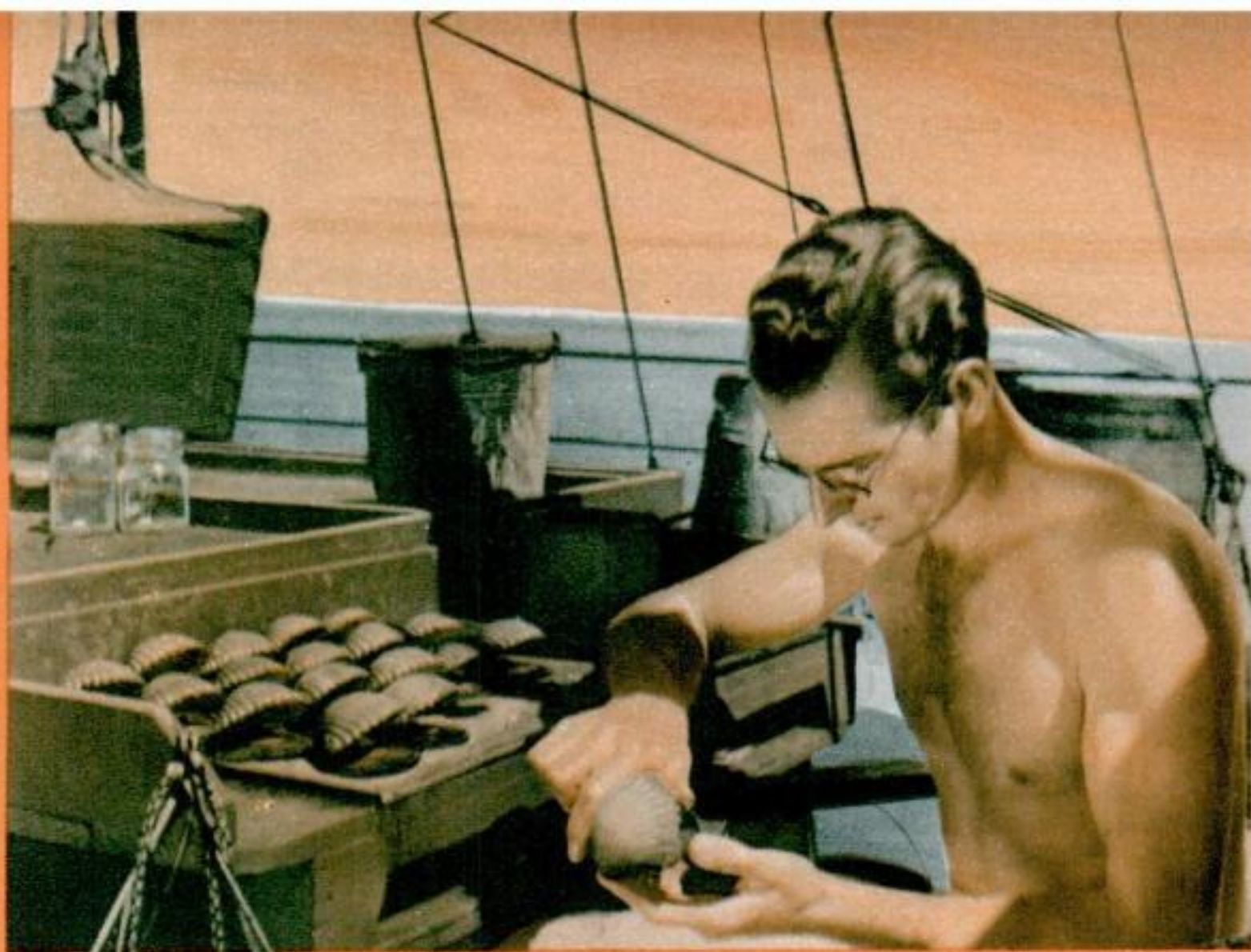


Barnacles growing upon the back and claws of a cancer crab



APARTMENTS IN SHELLS

L. M. Paquette is seen opening the odd pecten shells which are shared by scallops and diminutive crabs



In shallow waters, a small dredge is dragged along the bottom by this twenty-three-foot whaleboat. The dredge consists of two bags, one coarse and one fine mesh

Photographing specimens in a tidal pool. Pictures are made through a water glass, the interior of which is illuminated by means of a reflector as illustrated



Quickly adjusting the lens, he obtained a rare picture of the egg case of the giant ray or skate, a vicious sea monster which weighs several tons. The case measured three by six inches, and was light enough to float.

Six hundred miles north of the Galapagos, searching along the California coast near Port San Luis, another expedition member captured an edible cancer crab. Not startling in itself, for the crab is common enough; but to the body and members of this fellow were attached scores of barnacles. Some were tiny newcomers, while other had been living on his hard structure for many moons. Both the crab and

barnacles are mobile, the barnacles being free swimmers. They attached themselves to the crab by their heads and kicked food into their stomachs with their feet.

Crabs cannot protect themselves against barnacles, but spotted puffers inflate themselves almost into a sphere when pelicans or pursuing fish threaten to gobble them up, thus effectively defying their enemies. Some seen over the sand of shallow bays in the Gulf of California are ten inches long. They have parrotlike beaks, yet unlike birds seem to possess real incisors.

Ichthyologists know that flying fish do not really fly. They leap from the water and soar like birds in flight. Butterfly flyers often gather under the cargo light when *Velero III* drops anchor at the Galapagos, and will follow a moving light, sailing hundreds of feet on vibrating fins. They frequently "catch themselves" by leaping into the boats.

The scientists go deeper than the surface for rarer specimens.

In dredging in deep water, down say to a half mile below the waves, 7,000 feet of steel cable are paid out over the bow of *Velero III*. As the cruiser moves astern at half speed on one engine, the four-foot dredge scrapes

along the bottom. When several hundred pounds of materials are thought to have been trapped, a winch hauls the catch slowly to the surface. A half day often is required for a single round trip of the dredge. In shallower waters, as deep as a quarter mile, a smaller dredge slides downward from a platform at the stern of a whaleboat. Both these dredges are double bags, the outer coarse and the inner consisting of fine-mesh cloth through which tiny specimens cannot escape. Each has an oblong mouth made of steel.

Unusual finds, particularly fish caught at great depths which may not survive long, are placed immediately in small aquariums on deck and photographed. For these a stage is set, the aquarium being seascaled to provide natural surroundings. Thus rare specimens succumbing in the diminished surface pressure live forever in pictures.

While many of the creatures captured in the ocean depths seem like freaks when compared with more familiar varieties, they are as natural in their own habitat as their relatives living in shallower waters. By dropping their dredges onto the ocean floor, the scientist-explorers aboard *Velero III* are penetrating a new and uncharted realm of marine life.

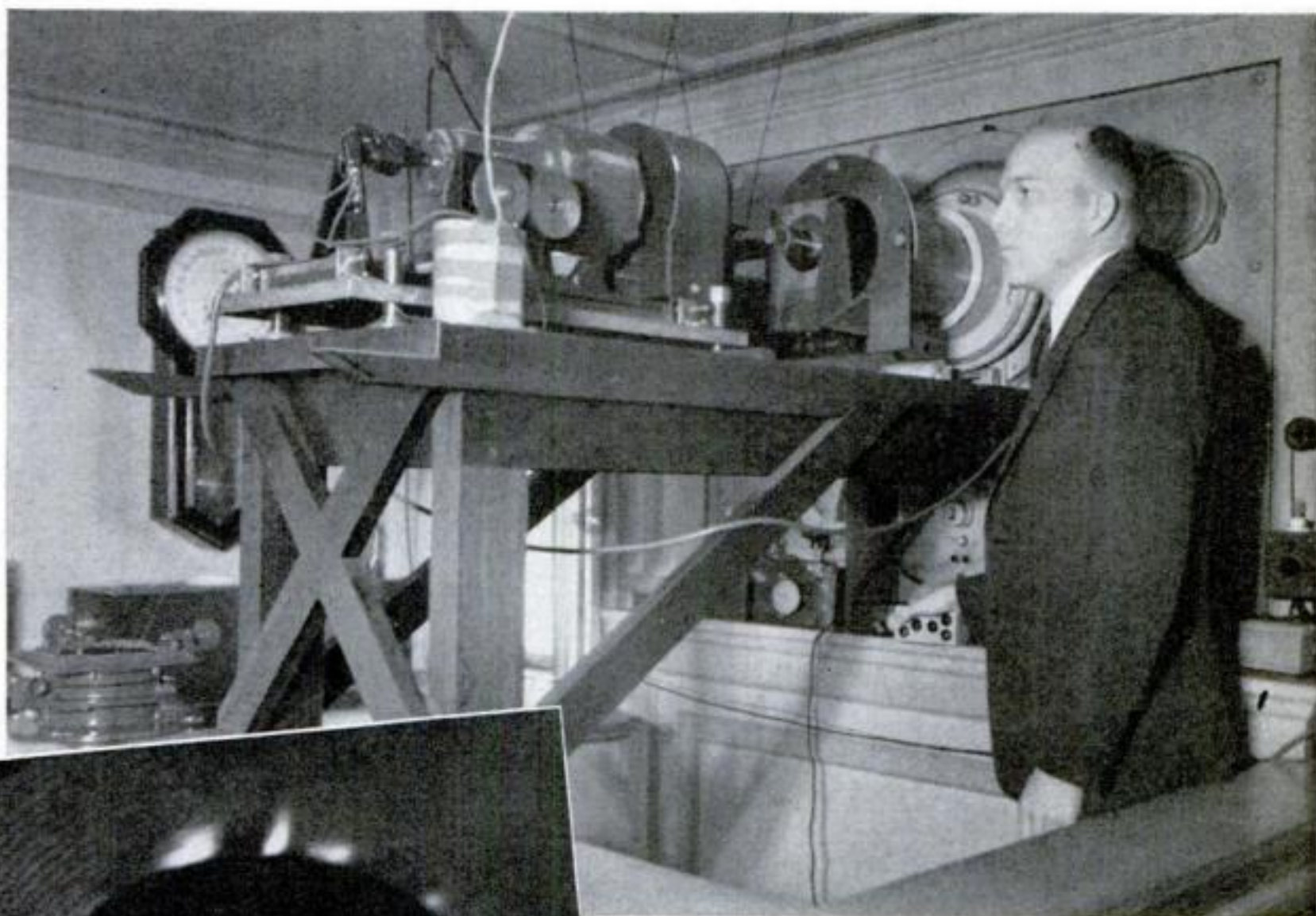
Dredging winches and other gear on the forward deck of the "Velero III" during operations



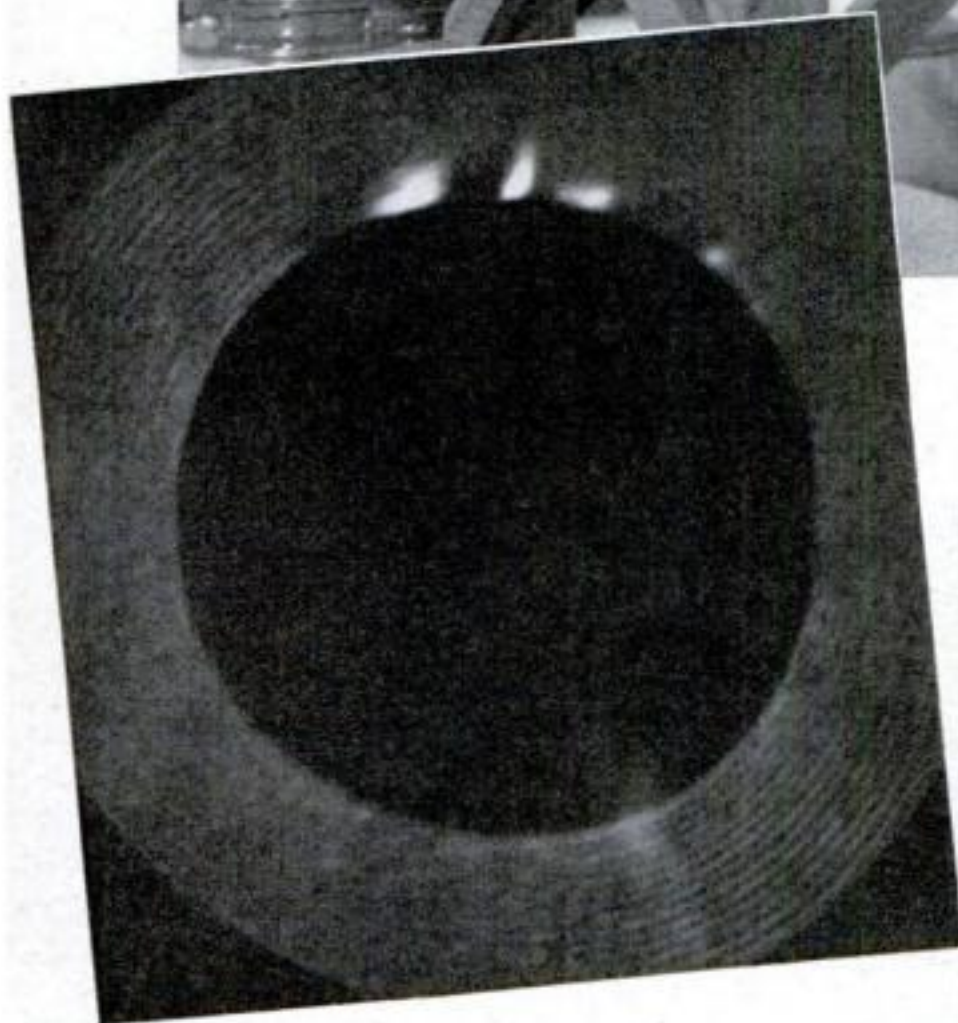


This butterfly flying fish can sail through the air for several hundred feet at a time. With its fins stretched out, it resembles a monoplane in its flight

Television Camera Shows Sun's Corona



Transmitting and, below, receiving units of the "coronavisor." At left, how the corona of the sun looks when viewed through the system. The bright spots at the top are prominences



NO LONGER need astronomers wait for a total eclipse to view the sun's corona, or halo of glowing streamers, which usually is masked by the thousandfold brighter light of the sky. In a "coronavisor" perfected by the Bell Telephone Laboratories, a television camera spirally scans the area around the sun's disk, and electrical filters discard all reception produced by the sky's uniform light. Thus the "unmasked" corona, and brilliant prominences at the sun's rim, are clearly seen against a black background on the viewing screen. The new aid may help forecast solar disturbances that trouble short-wave radio transmission.





Crane Car Speeds Up Track Laying

A GIANT track-laying machine designed by T. Platov, a Soviet engineer, is now being used in the construction of new railway lines in Russia. Rolling on sections of track already laid, the device is coupled to flat cars on which are piled standard-length sections of rail already spiked to ties. A crane

picks up one section of track, swings it out in front of the machine, and lowers it into place on the previously prepared roadbed. Workmen then fasten it in place, and the track-laying car advances over it into position for laying another complete track section, as shown above.

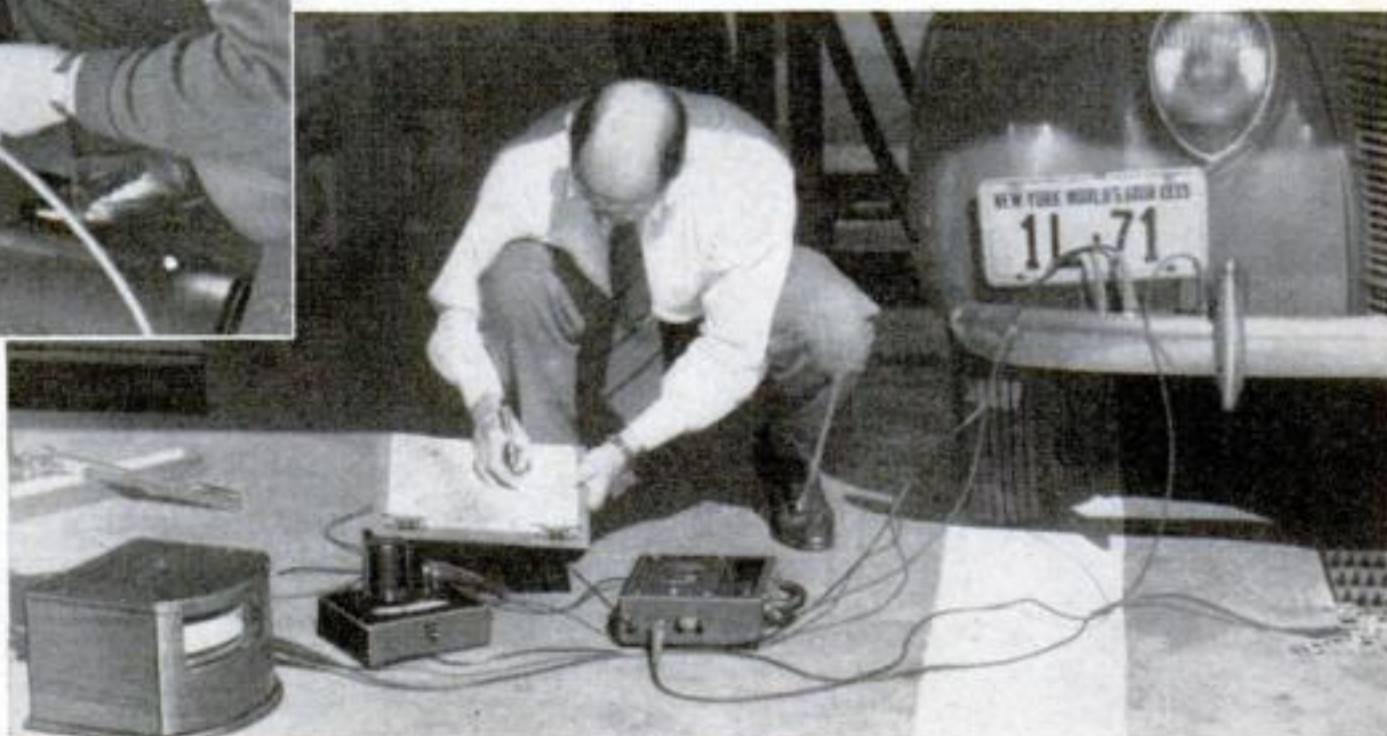


Prof. R. Beach applies a test prod to the fender of a car running on rollers

At right, measuring with instruments the amount of static discharged by car

Secrets of Static Electricity Revealed in Car Tests

STATIC electricity in charges as high as 11,000 volts is often generated in automobiles that speed over concrete or asphalt roads. This is one of the interesting facts established by Prof. Robin Beach, of the Polytechnic Institute of Brooklyn, N. Y., who is conducting a comprehensive study to determine how static electricity is generated and released by cars.





Amplly padded against injury, this fireman landed in a thicket. His parachute disposed of, he'll be ready to fight a forest fire

Flying Fire Fighters Parachute to Work

PLUNGING earthward by parachute, Government flame fighters may soon reach otherwise inaccessible sections of a forest to snuff out beginning fires. This spectacular method of coping with a menace which brings an annual loss of more than \$100,000,000 to Americans, was recently demonstrated successfully in forest areas near Wenatchee, Wash.

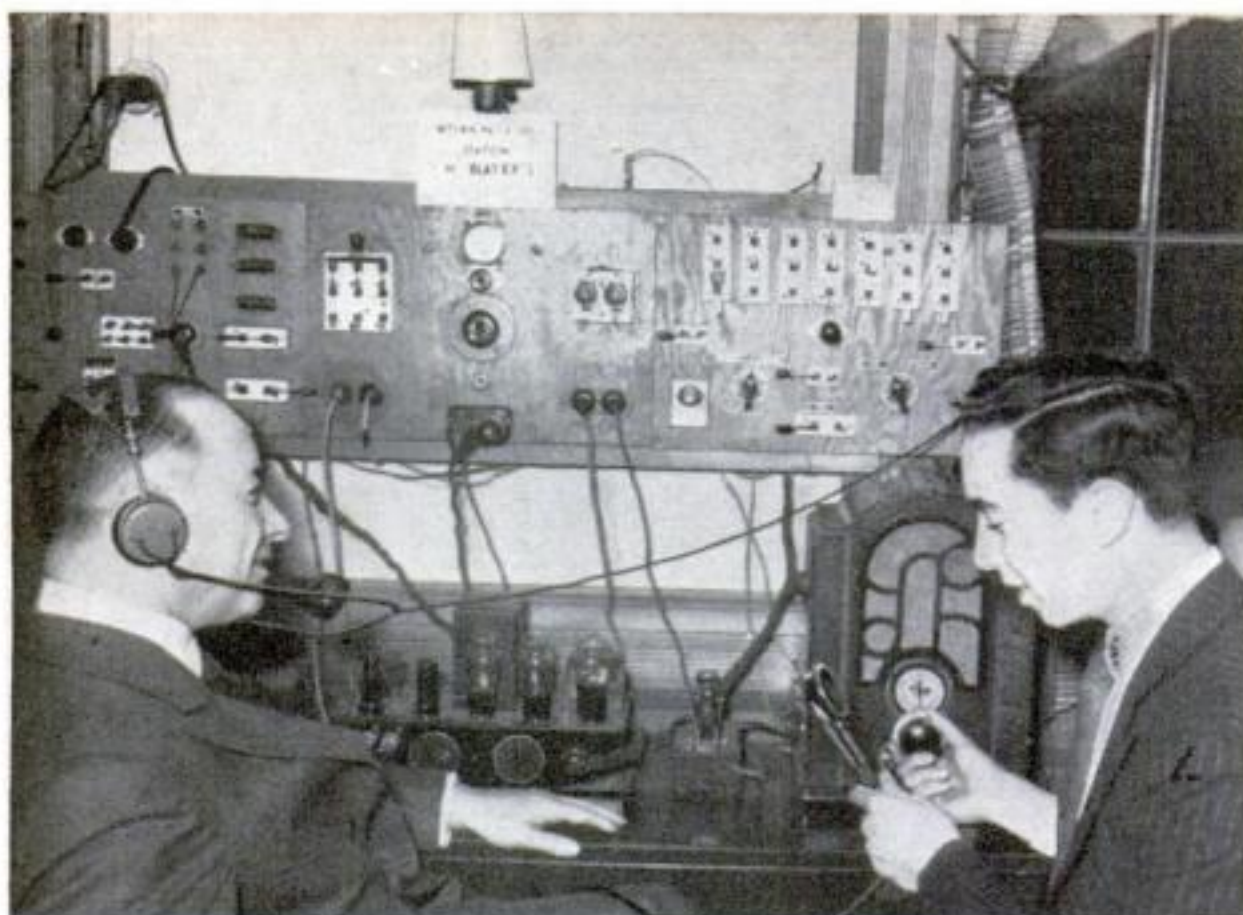
Clad in a special suit of canvas and sponge rubber, and protected by a face mask of metal mesh, Frank Derry, West



Planes and parachutes will rush forest-fire fighters up to the scene of action

Coast parachute jumper who coöperated with officials of the U. S. Forestry Service, stepped off the wing of a circling plane and dropped unharmed into the thick forest growth 2,000 feet below. Smoke eaters of the Forestry Service, carrying compact fire-fighting equipment on their backs, could thus reach the scene of a remote forest fire almost as soon as smoke was sighted.

Subduing flames in this manner, before they could spread, would save millions of dollars a year. During the twelve months of 1938, alone, fire destroyed nearly 34,000,000 acres of timberland, an area virtually equivalent to the whole of New England. The annual average number of forest fires in the United States is around 175,000, of which about 15,000 are started by lightning. A new blaze begins on the average of once every three minutes.



College Sophomore Wires His Campus for Sound

FOLLOWING in his father's footsteps, Edward Sarnoff, son of David Sarnoff, president of the Radio Corporation of America, is managing an unusual broadcasting network. The system, installed at Brown University, Providence, R. I., where young Sarnoff is a sophomore, is similar to the wired-radio systems established in many major cities. Programs originating in the college studio are sent out over wires to the various campus buildings, where students listen to musical programs, news, and announcements concerning college affairs. In the photograph above, David Sarnoff listens in as his son speaks into the mike.

Saddle for Knee Holds Complete Manicure Set

DRAPED over the knee like a miniature saddle, a manicuring aid recently introduced consists of a broad strip of soft woolen cloth fitted with convenient pockets that hold nail polish, cuticle remover, emery boards, orange sticks, and other manicuring accessories.



Everything needed for a manicure is held in the pockets



A hand-size power tool has a complete set of accessories for shaping, cutting, and sanding various plastics

Kit for Carving Plastics Has Small Power Tool



COMPLETE tools and materials for carving plastics are now available in kit form. Made in small and large styles, the kits include an electric hand-size power grinder and a complete set of quickly-attached cutting, polishing, and sanding wheels.

A supply of plastic materials in tube, sheet, and rod form; pins, screws, glass, and an enameling brush; and a complete project book with suggestions on what to carve and how to carve it, are also part of the outfit.



British gunners in training. Numbers on their backs help instructors to identify them

Numbers Mark Soldiers in Training

NUMBERED like football players, members of a British gun crew learn how to play the grim game of war. During a practice exercise, the numerals on their backs aid the in-

structor to coach each individual in his duties, so that perfect teamwork will result. The picture above shows gunners training "somewhere in England."



Spraying a tree with a winter protective chemical

Spray Replaces Burlap for Protecting Trees

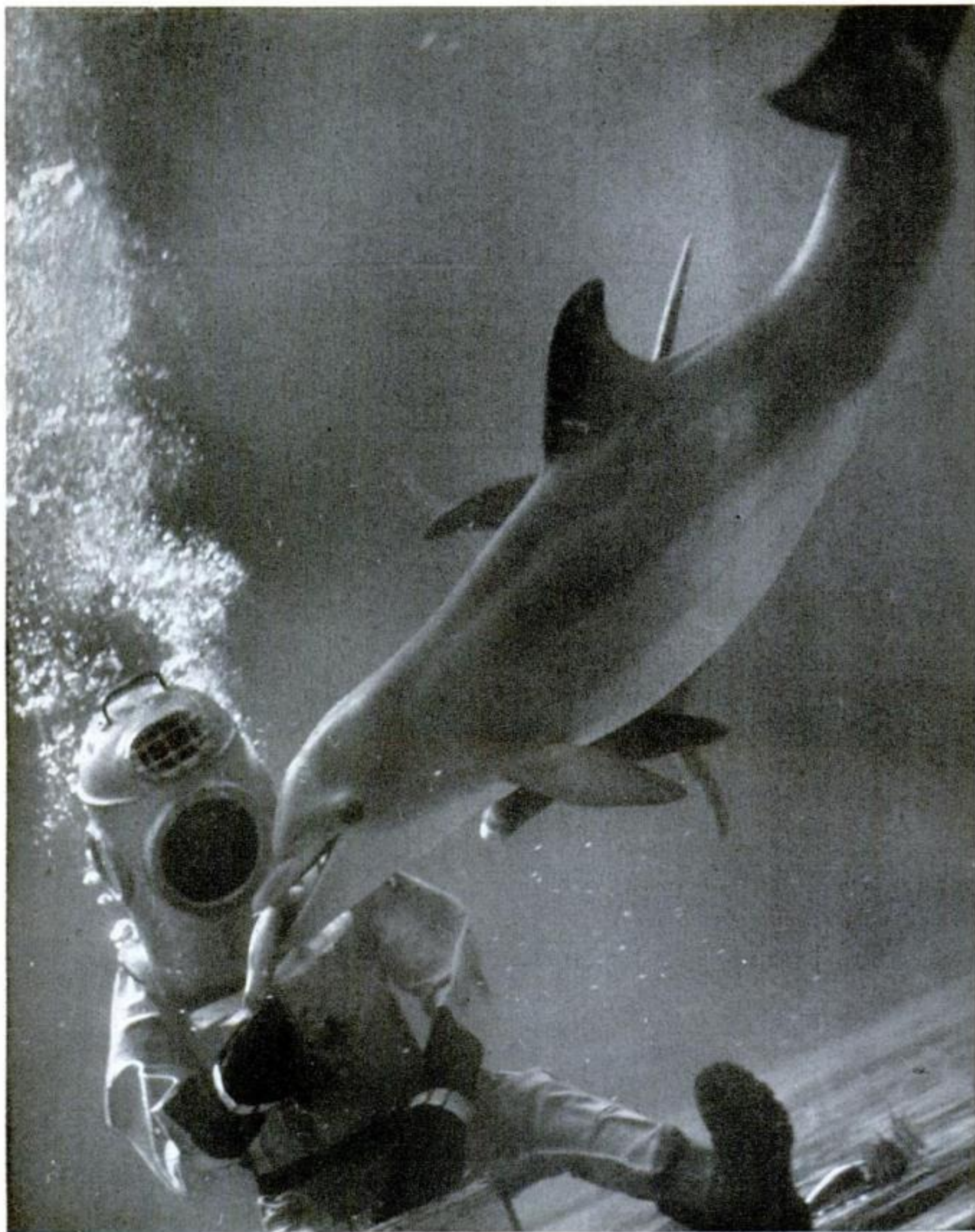
FOR protecting valued trees against the rigors of winter, a new chemical treatment takes the place of burlap wrappings. The picture at left shows the protective compound being applied with a spray gun to a dogwood tree.

Handle Opens New Knife

BY ROTATING its cover through a complete circle, the springless blade of a new "safety-first" pocket knife is locked open or shut. It cannot snap back on a finger, and need not even be touched to open or close it.



This knife can be opened without touching the blade



Daring Diver Feeds Diving Dolphins

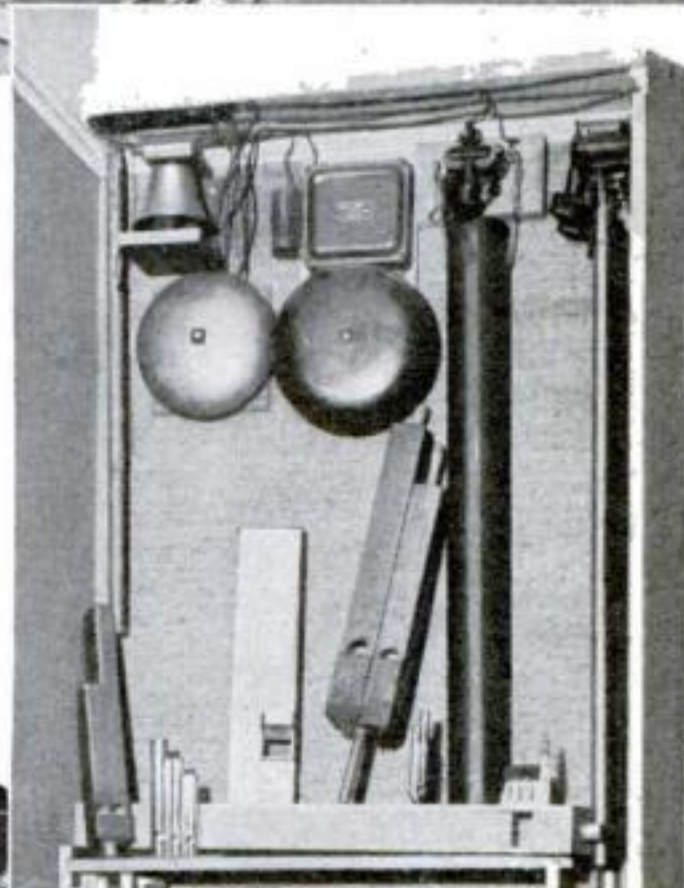
AN UNDERWATER picnic at which a diver hand-feeds a school of porpoises while at the bottom of an outdoor tank, is a novel stunt performed daily at an aquarium in Marineland, Fla. Dressed in full underwater regalia, the diver enters the tank carrying a wire basket full of small fish. Descending

to the bottom, he sits on the tank floor twelve feet below the surface and feeds the aquarium's dolphins by hand. The unusual photograph above was snapped through a window in the side of the tank as one of the graceful creatures paused only long enough to snatch up a mouthful.

Christmas-Tree Village Comes to Life

TWENTY-ONE rheostats, thirty-three switches, and six telegraph keys, mounted on half a dozen switch panels in between an array of voltmeters and ammeters, control an amazing Christmas-tree display developed by William C. Mulhausen, of Brooklyn, N. Y., over a period of fifteen years. In front of the tree, which is decorated with 196 red, white, blue, and green rheostat-controlled bulbs, is a miniature village complete with trees, houses, a church, lighthouse, windmill, and other buildings. Back of this is a panorama, depicting a forest scene, painted on glass and back-lighted.

A miniature farm borders the tiny village on the right, and a harbor scene, with ships riding on a glass mirror that simulates water, is placed at the left. Buildings and boats are lighted from within, and various noise makers in a box mounted on a motor-driven shaft produce the brays and bleats of the farm animals. A toy hand organ driven by a second electric motor makes music for the church.



William C. Mulhausen mans the controls of his electrical village



Set at the base of the Christmas tree, the layout represents a peaceful yuletide scene. Lower picture, some of the off-stage sound effects

Write a Letter and Win a Prize!

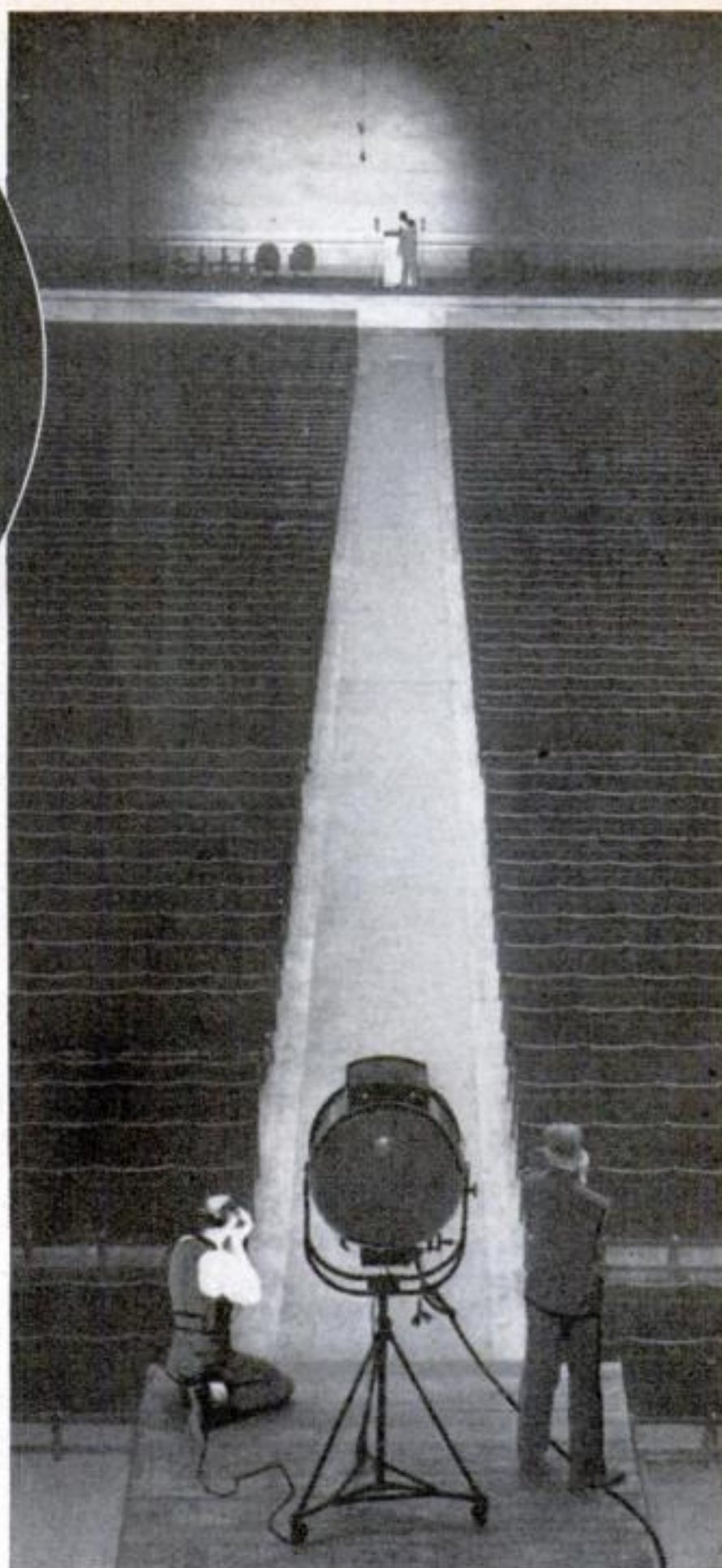
HERE'S your chance to earn some money to buy new tools or equipment for your hobby! POPULAR SCIENCE MONTHLY is offering \$100 in prizes for the best letters from readers, telling what they like best in this issue, and why. Turn to "Our Readers Say" for details, and get your letter off at once. It may be a winner!



One bulb in spotlight lit the stage 265 feet away for the photo at right. Not much bigger than a peanut, it is adaptable to flash guns

Midget Flash Bulbs Aid Cameramen

PHOTOFLASH bulbs so tiny that more than two dozen can be carried in a coat pocket have just been introduced. With glass globes smaller than a golf ball, their improved efficiency is said to give them more light for their size than any existing type. Made with bayonet-type bases like those of auto lamps, the wire-filled midgets are for use in hand reflectors, or in spot projectors as shown in the photograph at the right.

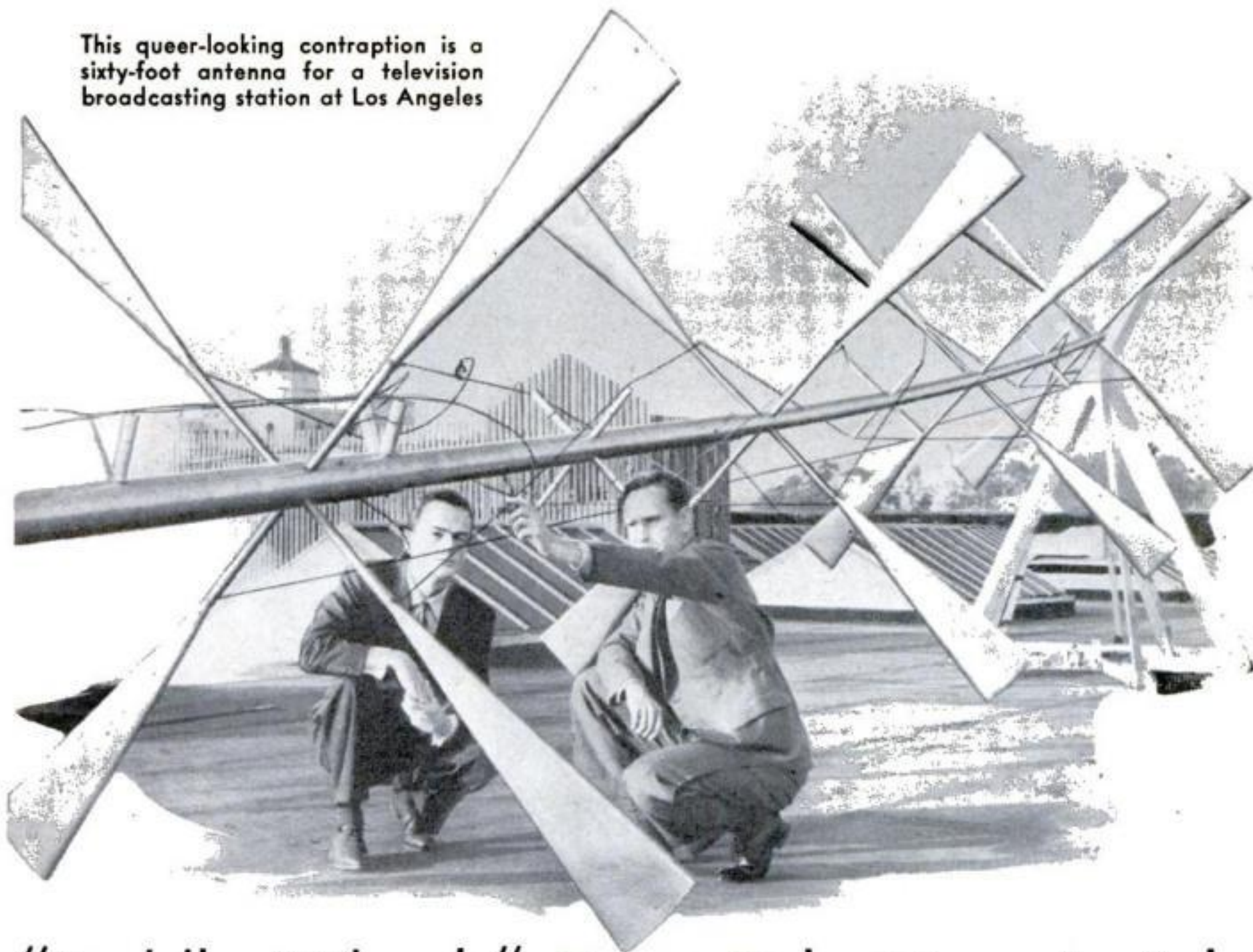


This roller-skating attendant wastes no time walking

Gas-Station Attendants Wear Roller Skates

ATTENDANTS wearing roller skates make quick work of filling a motorist's needs, at an Oklahoma service station. Practiced in performing all their duties on wheels, they fill a customer's gas tank, check his water and oil, clean his windshield and windows, and send him on his way with a minimum of delay. According to the proprietor who put the idea into use, patrons have expressed their hearty approval of the innovation —after getting over their astonishment on seeing the attendants approach their cars in this unusual fashion.

This queer-looking contraption is a sixty-foot antenna for a television broadcasting station at Los Angeles



"Paddle Wheels" Form Television Aerial

NO MATTER what you guessed to be the purpose of the windmill-shaped thing above, you'd probably be wrong. Actually, it's the newest fashion in television transmitting

antennas. Just completed for a broadcasting station at Los Angeles, Calif., the big aerial measures sixty feet long and will be mounted vertically.

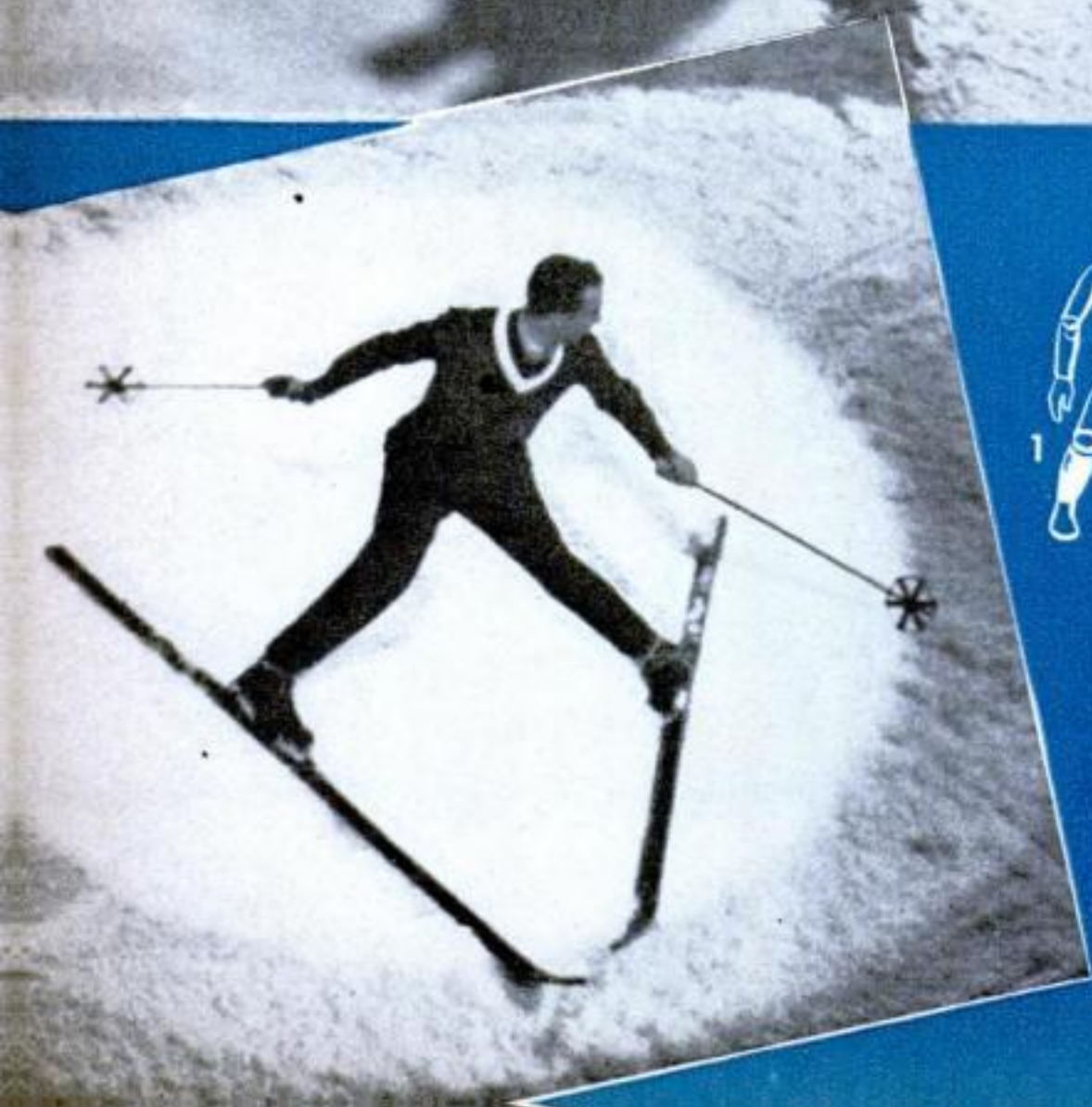
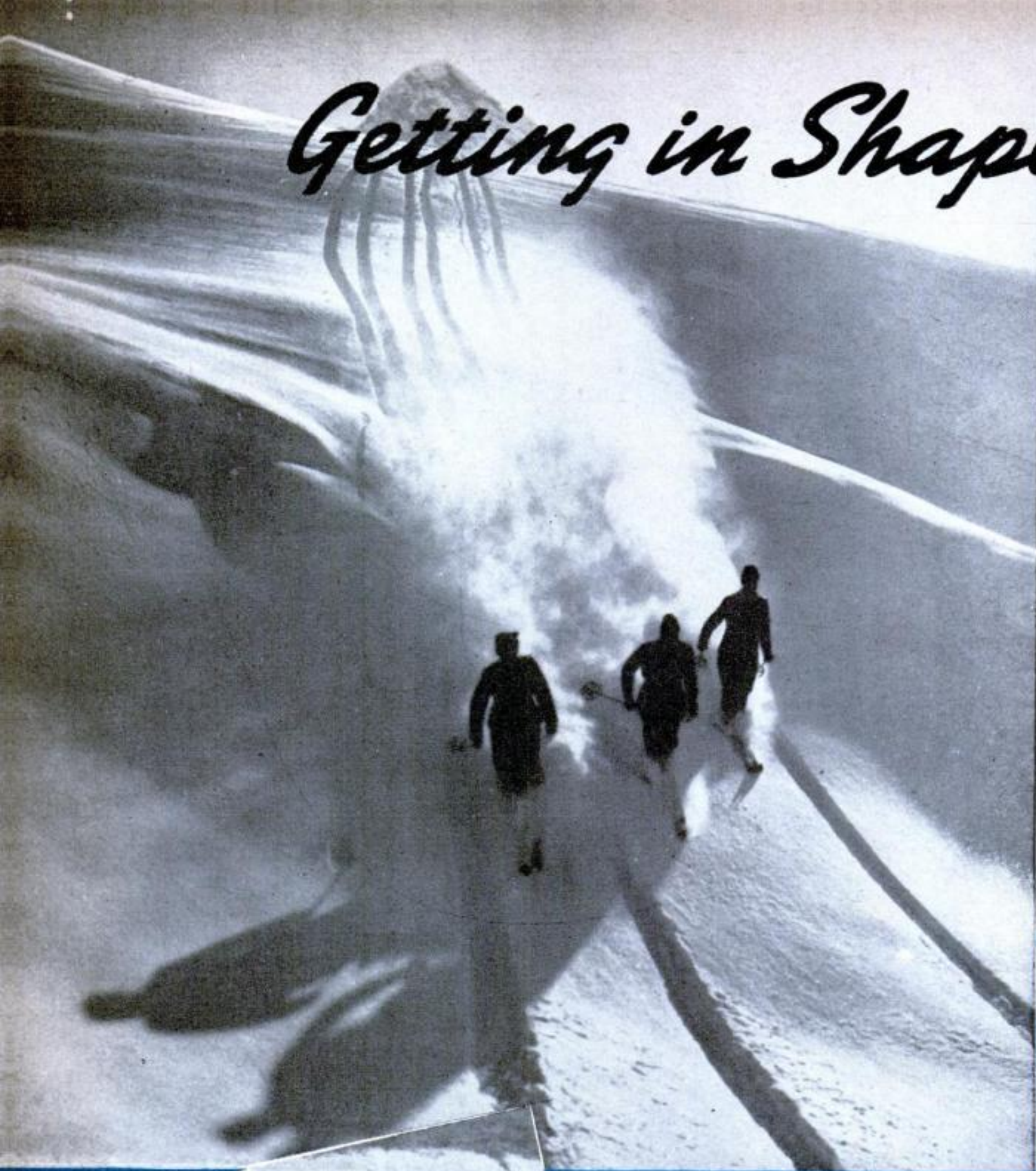
How To Gather Fleas from a Grizzly Bear

How to get fleas from a grizzly bear might puzzle a less resourceful man than Walt Sutter of Tacoma, Wash. From a radio program he learned that a wealthy Englishwoman was in the market for grizzly-bear fleas, to complete a collection taken from various wild animals. So he went to a zoo with a long-nozzled vacuum cleaner, and soon the coveted specimens were in the bag, ready for a purchaser.



Walt Sutter harvesting grizzly-bear fleas to sell to a flea collector

Getting in Shape



SNOWFLOW BRAKE OR DOUBLE-STEM TURN. (1) Stand with feet apart, toes pointing in, weight on both feet; dip at knees, bending little if any at hips, keeping heels on floor. (2) Dip, swinging hips to left and putting weight on left foot. (3) Dip again, swinging hips to the right and putting weight on the right foot

for Skiing

WHEN the first storm of winter sheathes the countryside in a soft blanket of snow, thousands of enthusiastic fans will dash for the nearest slope to test their skill on skis. But the odds are 100 to one that the great majority of them will find their muscles refusing to behave, and will roll out of bed the following day stiff as an oak plank and creaking in every joint. For skiing is not merely riding down hill on wooden runners, but a strenuous exercise requiring poise, balance, and, above all, muscular control. Accomplished skiers never start a new season on snow without first putting themselves through a



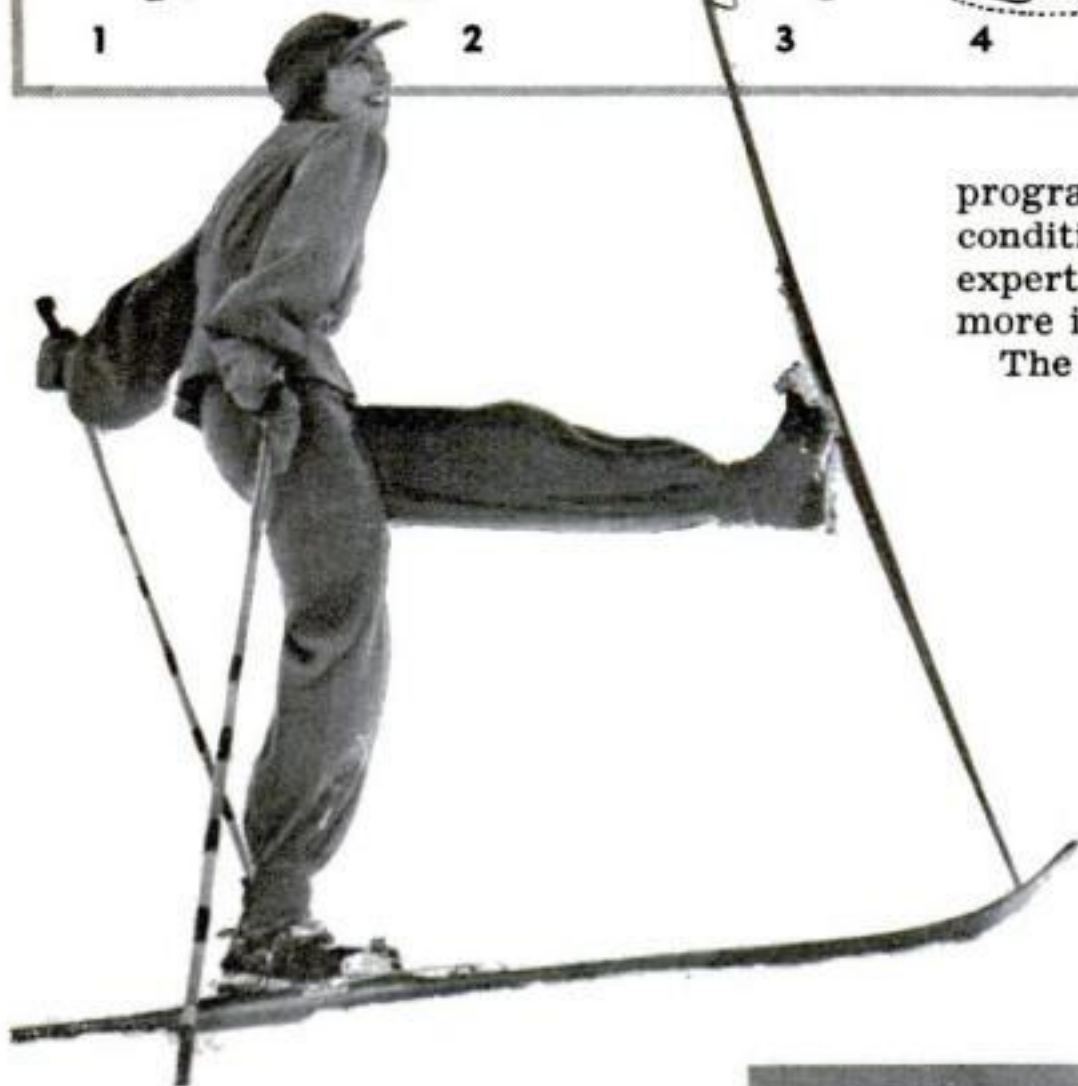
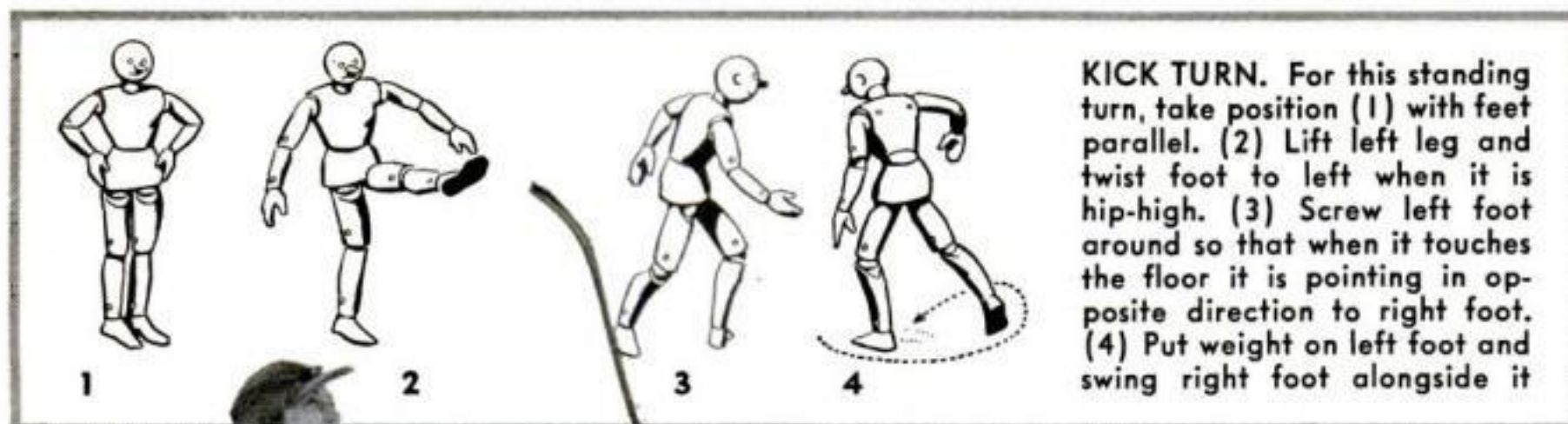
CHRISTIANA TURN

(1) Stand upon a small rug laid on a polished floor so it can slip; have the feet parallel and slightly apart, knees bent a little, body leaning a bit forward: (2) Dip and rise, swinging body to right. (3) At top of movement, skid feet in clockwise direction. Body leans to the right; left shoulder leads. Reverse for a turn to left



HERRINGBONE. To practice this hill-climbing stunt, stand in position (1). Put weight on left foot (2), bending it slightly at knee; raise right foot until knee is hip-high. (3) Lunge forward and to right, transferring weight to right foot; clinch left fist and raise it. Repeat to the left

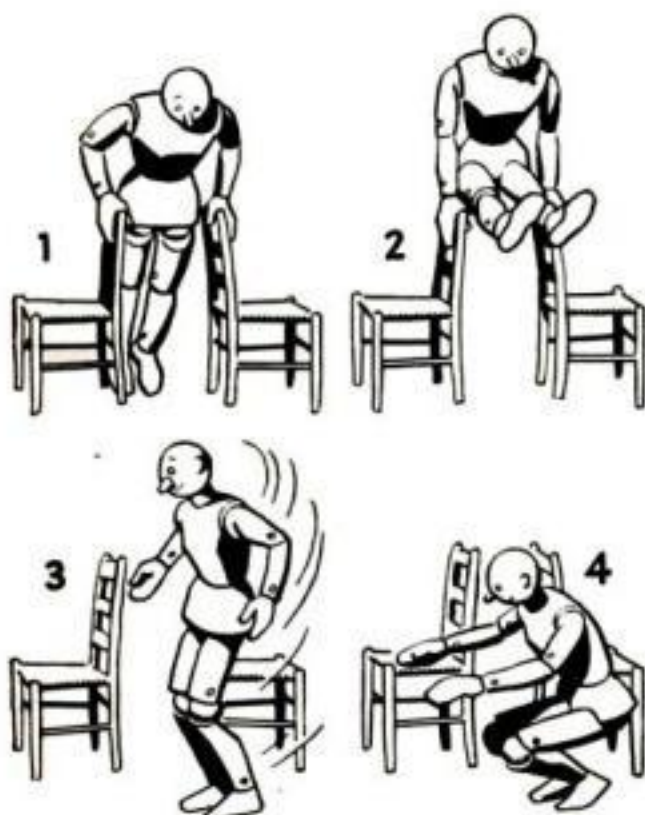




program of exercises that limber, tone, and condition their muscles. For the beginner, experts say, preliminary exercises are even more important.

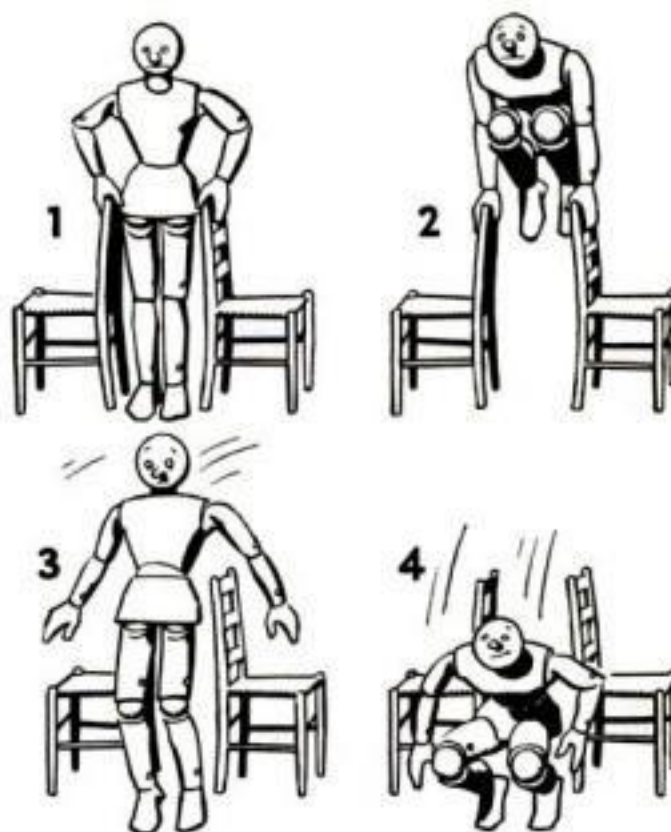
The familiar "daily dozen" that includes knee-flexing, hip-twisting, and deep draughts of fresh morning air, is a good routine to start with. But for more ambitious skiers, special exercises have been devised to get muscles into top-notch shape for performing the turns, brakes, and other skiing maneuvers. Six of these exercises are outlined on these pages. Faithfully performed, they should help any enthusiast get into first-class shape for an acheless season of good skiing.

JUMP TURN BETWEEN POLES. Set two straight-backed chairs as shown, 18 inches apart. (1) Lean forward with body weight supported by arms, hands grasping middles of chair backs. (2) Swing legs forward parallel to floor. (3) Twist the feet to right and land with legs stiff, feet at right angles to first position. (4) Dip with knees bent to absorb shock.





GELANDESPRUNG. This flying leap is practiced with chairs placed as for the jump turn between poles. Stand between the chairs (1), grasping the backs with the hands. (2) Lift the body, drawing the knees up near the chest, head and chest forward, hips high. (3) Return to floor with knees bent only slightly. (4) Take up the shock by bending into a crouch



Learn to ski by the sea:
The enthusiasts at the left
are receiving instruction
on the sands of the shore

Aloft, the tiny "pickaback" glider releases parachutes, then rides one back to earth



For the take-off, the glider is mounted in a special cradle

Pickaback Model Cuts Aerial Capers

AN OUTSTANDING feature of a model-airplane meet held recently in Philadelphia, Pa., was a diminutive "pickaback" combination plane inspired by the full-size composite aircraft tested for Transatlantic service in England (P.S.M., Jan. '38, p. 30). Entered in a special stunt contest, the single-engine

model monoplane took off with a small glider mounted on its back in a special cradle. After gaining sufficient altitude, the plane automatically released the glider, which soared away, released two tiny parachutes, and then unfurled a third chute by which the glider itself floated down.



This playroom electric phonograph will play twelve-inch records

Tiny Phonograph Has Cone Speaker Set in Tone Arm

DESIGNED for children's use in a nursery or playroom, a diminutive phonograph now on the market is operated by an electric motor and employs a novel sound box. This consists of a diaphragm resembling a loudspeaker cone and housed in the phonograph tone arm, whose unusual shape can be seen in the photograph at the left. Not a mere toy, the machine will play records up to the twelve-inch size.



Hoop Marks Milestone for Train

A TRAIN crash was arranged recently to celebrate the completion of 8,000,000 miles of travel by the Denver Zephyr, a streamline train of the Burlington Route. Little damage was done, however, for the obstacle which the streamliner hit was a mammoth paper hoop. The celebration took place at the proper point on the main line of the railroad near Belmont, Ill., when the Diesel-powered train poked its nose through the paper hoop.

He's Never Caught Without a Pencil

COLLECTING pencils of all sizes, styles, and shapes is the odd hobby that occupies the spare time of B. D. Sumpter, of Topeka, Kans. Now numbering more than 7,000 individual items, coming from all parts of the world, the unusual collection includes more than 2,500 different mechanical pencils. In the photograph at the right, Sumpter, his wife, and a friend are shown arranging the items in the collection on the floor of the living room.



Some of the 7,000-odd pencils accumulated by B. D. Sumpter

ROOF-TOP STORES POWER



In one effort to harness sunlight, a Spanish inventor melted metals with solar heat gathered by prisms set in a spider-web frame



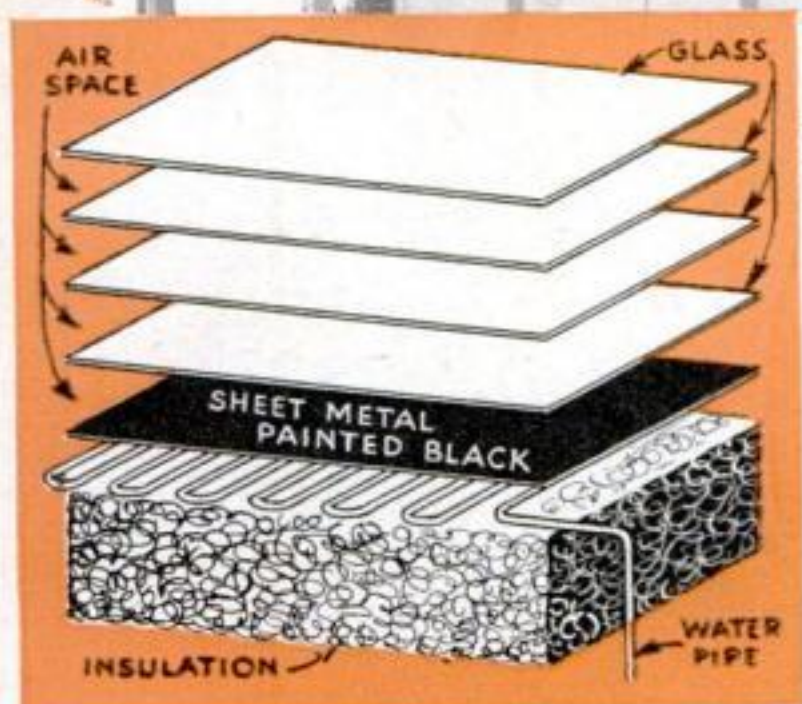
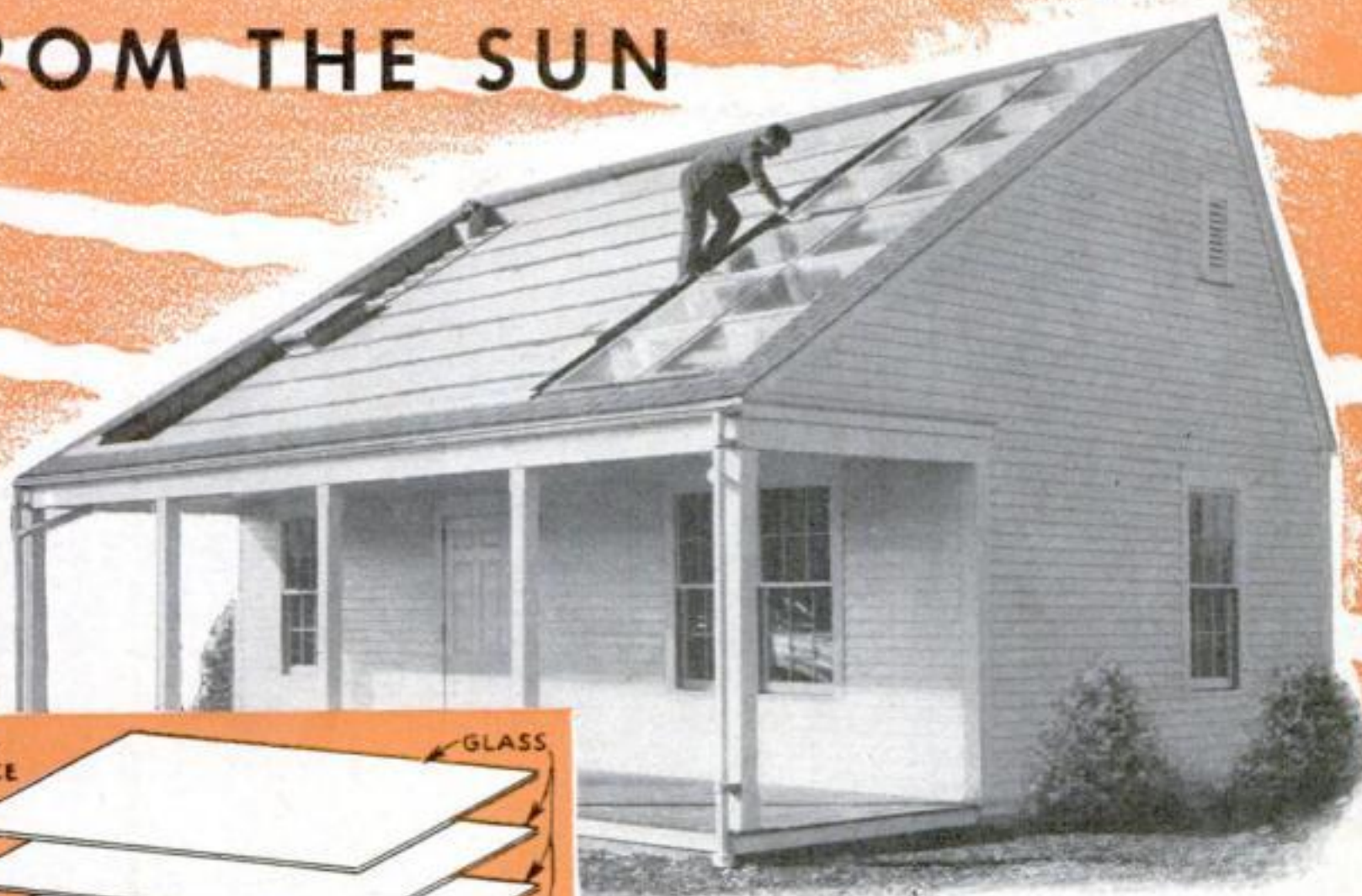
A TRAP FOR OLD SOL. Here a workman is polishing up the prisms of the solar furnace shown above. The tower turns to face the sun

HEATING homes in January with the warmth of last summer's sunshine—that is the exciting goal of research now under way at Cambridge, Mass. Not far from the Charles River, scientists of the Massachusetts Institute of Technology recently completed a white frame building, its sloping roof edged with a glistening battery of solar-heat traps.

These cells are formed of "sandwiches" of glass sheets, air spaces, and metal plates. The rays of the sun penetrate through the sheets of glass and strike a black metal plate at the bottom of each cell. It absorbs heat rapidly and the dead-air spaces between the glass panes act as insulators and keep the heat from dissipating outward. Beneath each metal plate, a maze of thin-walled tubes carries a flowing stream of water which is heated by contact with the metal and then conducted to an efficiently insulated storage tank in the basement of the building. Hot water can be stored in such tanks, it has been found, for weeks and eventually it is expected that "sunshine

HEAT TRAP

FROM THE SUN



"CANNING" SUMMER HEAT FOR WINTER COMFORT
Experimental house at Cambridge, Mass. On the roof, heat-trap cells like that at left will capture solar energy, which will be conserved for heating

furnaces' of the kind will be able to hoard summer heat for midwinter use.

For more than twenty centuries, experimenters have been striving to store up summer heat and trap the endless flow of power from the sun. Recent efforts to crack this age-old scientific nut range from Dr. C. C. Abbot's solar furnace to the "sunshine sandwiches" of Dr. Bruno Lange, of Berlin, Germany. His photo-electric cells generate current when struck by the sun's rays. Other experimenters have employed mirrors, tilted by clockwork, and giant lenses, concentrating heat to melt metals.



SUN HEATS HOT DOGS. Two Californians hitched a dog wagon to a star in this ingenious solar barbecue. A thermostatic control adjusts mirrors to reflect the sun's heat for cooking meats

Are You Having Any Fun?

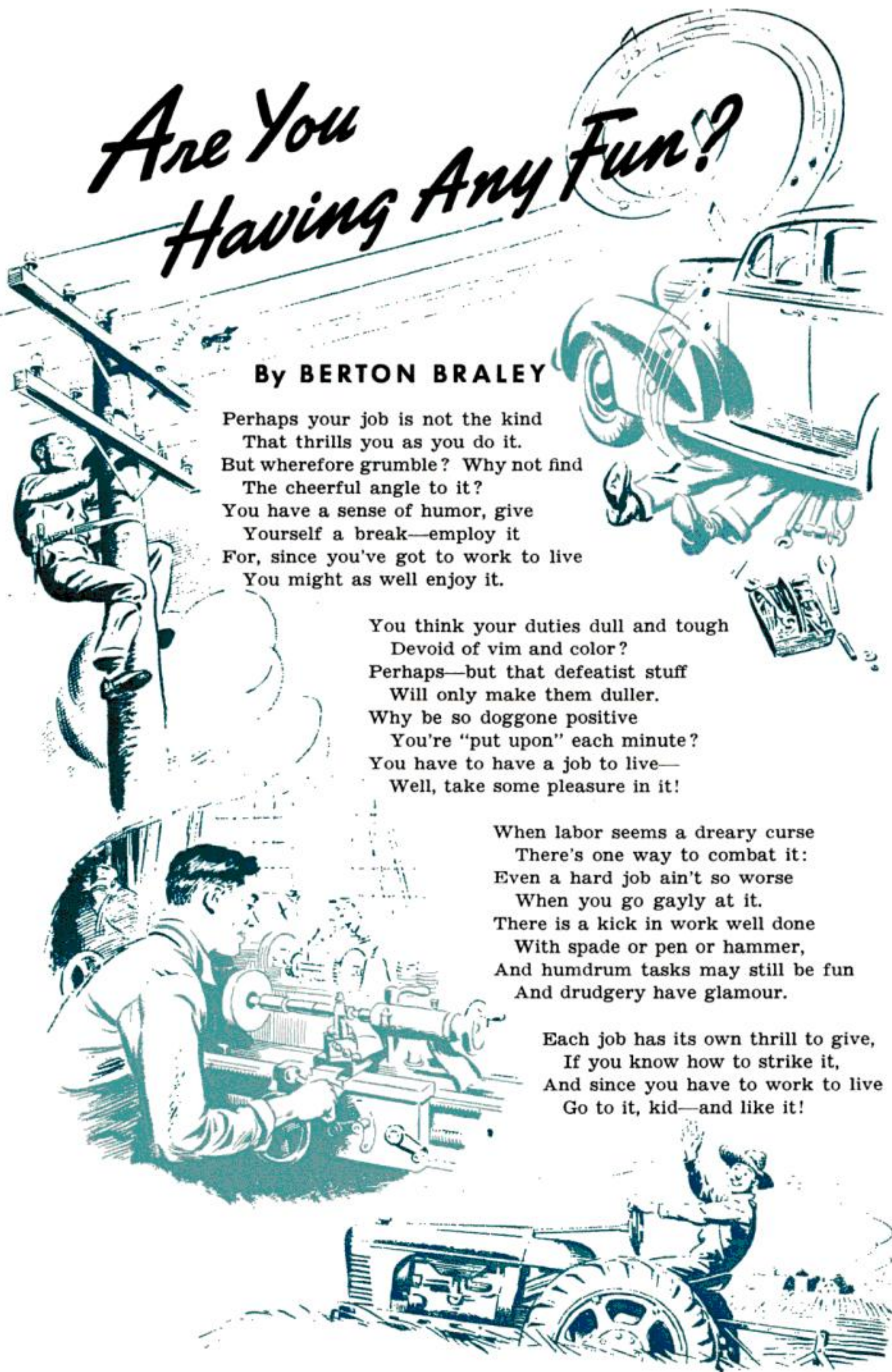
By **BERTON BRALEY**

Perhaps your job is not the kind
That thrills you as you do it.
But wherefore grumble? Why not find
The cheerful angle to it?
You have a sense of humor, give
Yourself a break—employ it
For, since you've got to work to live
You might as well enjoy it.

You think your duties dull and tough
Devoid of vim and color?
Perhaps—but that defeatist stuff
Will only make them duller.
Why be so doggone positive
You're "put upon" each minute?
You have to have a job to live—
Well, take some pleasure in it!

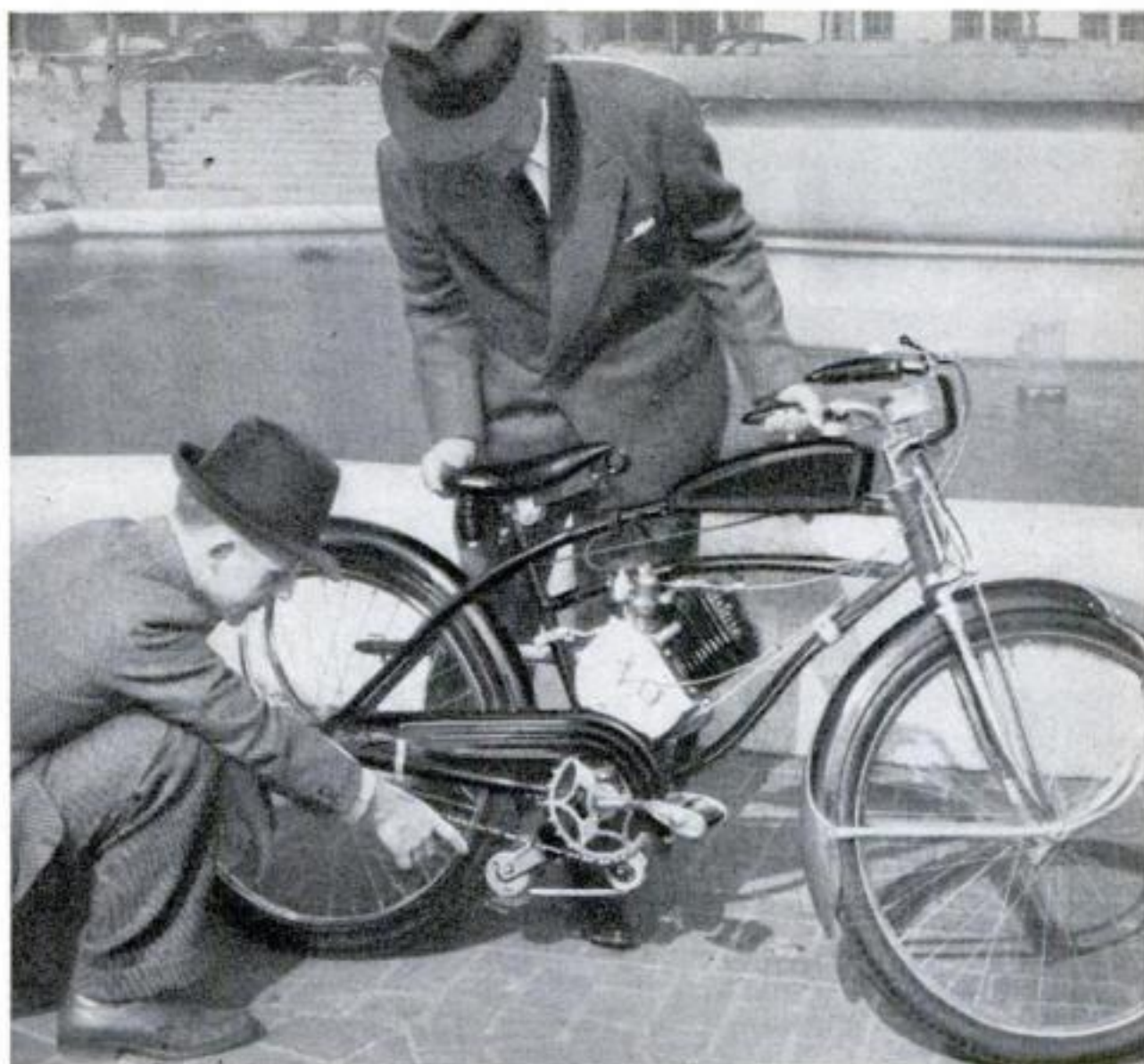
When labor seems a dreary curse
There's one way to combat it:
Even a hard job ain't so worse
When you go gayly at it.
There is a kick in work well done
With spade or pen or hammer,
And humdrum tasks may still be fun
And drudgery have glamour.

Each job has its own thrill to give,
If you know how to strike it,
And since you have to work to live
Go to it, kid—and like it!



Light Motor Goes on Bike in a Jiffy

WRENCH and screw driver are the only tools required to install a novel bicycle gasoline motor that drives a wheel 120 miles on a gallon of gas at speeds up to thirty miles an hour. Normal pedaling is not interfered with, since no structural changes are required. The motor fastens below the bicycle cross bar, driving the rear wheel by means of a special contact roller against the tire. The twenty-five-pound, four-cycle motor is rated at one and three-eighths horsepower.



The man is pointing to the special roller drive that contacts the tire

Model Circus Bandwagon Holds Ten-Piece Band

PRESERVING old-time circus equipment in scale-model form is the unusual hobby of James F. Craven, retired Glendale, Calif., mechanical engineer. His outstanding reproduction, pictured below, is a model circus bandwagon, complete with an eight-horse team and a ten-piece band. Craven spent two weeks measuring every detail of the prototype, and then labored for 1,800 hours completing the model, which employs separate castings of every part except the musical instruments. It weighs sixty pounds.

Nearly every part of the circus bandwagon was cast from molds made from carvings like the one at left

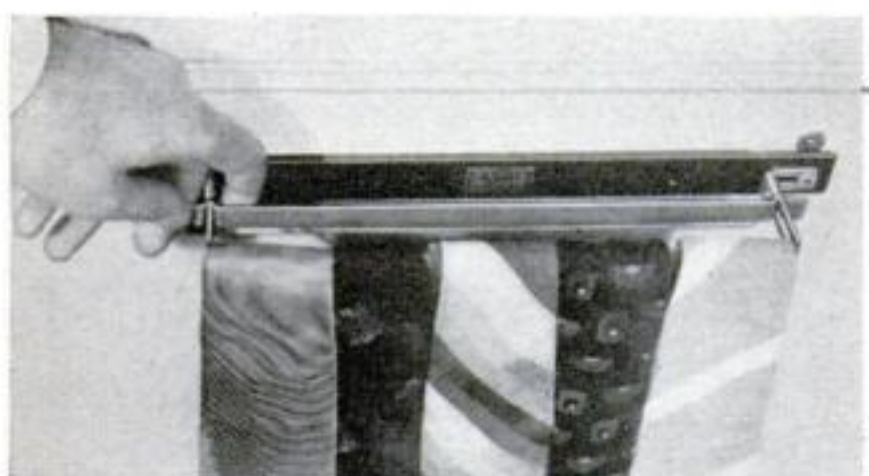




This sidewalk printing shop puts any headline you wish on a local paper

Headlines Are Made to Order While You Wait

PRINTING special headlines to order on copies of a newspaper is the unusual sidewalk enterprise recently inaugurated in Hollywood by two Californians. Attracted by the novelty of the idea, passers-by pay twenty-five cents to have their names included in bold-type headlines of their own composing, which are set up and then run off on the portable curb-side press.



Held between rods, neckties can't fall to the floor

Spillproof Necktie Rack

NECKTIES will not slip nor slide off a novel hanger just placed on the market. Ties are draped over a metal rod held out from the hanger's wooden back by two side arms. A second metal rod, which likewise may be used for neckties, snaps forward to hold the ties in place and prevent them from slipping off. This is pushed back out of the way when selecting a tie from the hanger.

Bergen and McCarthy Build a New Ant Trap

WHEN a horde of invading ants threatened to take over the Beverly Hills, Calif., home of Edgar Bergen, the well-known radio and screen ventriloquist retired to his home workshop and built a novel ant trap. The invention consists of a rectangular wooden base, beveled on the sides, and fitted with metal plates on the top and side edges. The plates, slightly separated from each other, are connected through a transformer to the house electric current, and a bit of honey is smoothed on the top to lure the insects. An ant climbing up the sloping side of the trap spans the gap between the plates, and causes a short circuit that electrocutes it.

\$100 IN PRIZES for letters telling what you liked best in this issue, and why. For details see "Our Readers Say."



Edgar Bergen dusts dead ants away from his ant trap



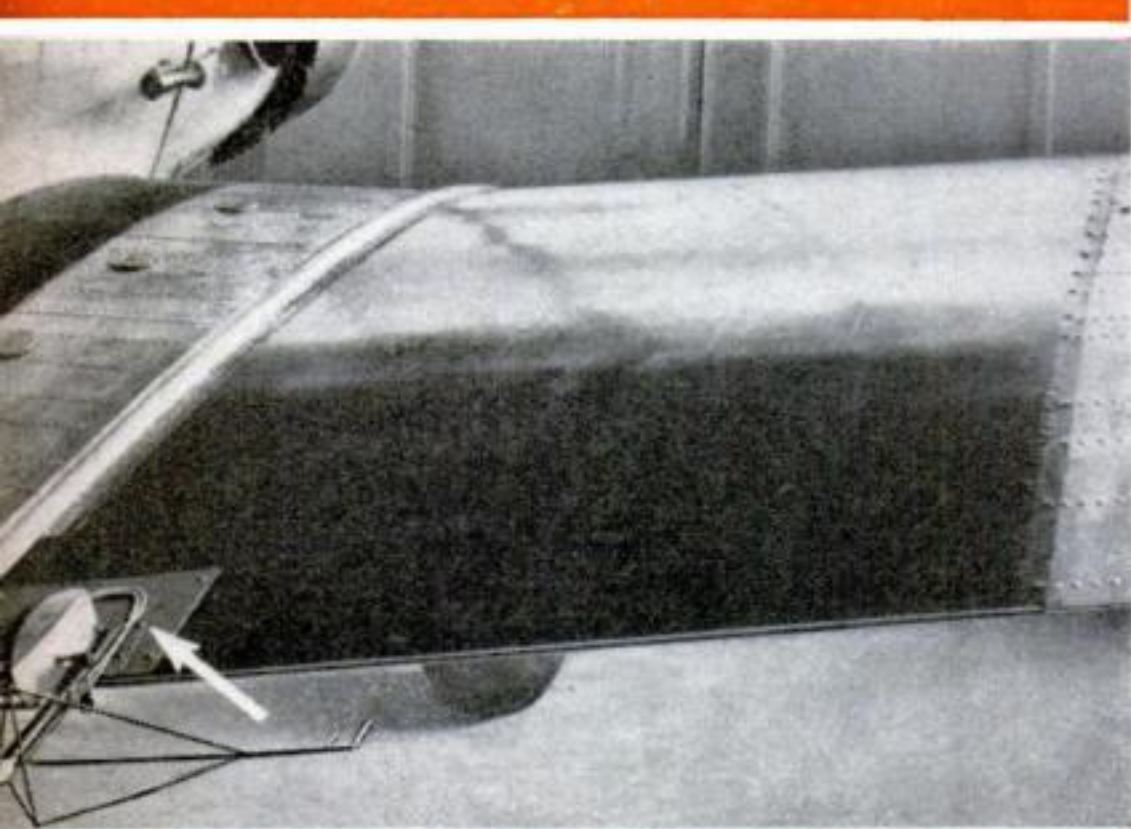
600 Miles an Hour

By
ARTHUR
GRAHAME

IT WILL be three or four times as large as the world's largest airplane of today. It won't have any body—its engines and its passenger accommodations will be in its wings, but its wing surface will be smaller, comparatively, than that of present-day planes. It won't have any tail. It will be fifty percent faster than the fastest-flying 1940 airliner.

That's the commercial airplane of the not-so-distant future as I heard it word-pictured recently by one of our leading flight scientists, Dr. Edward P. Warner, vice chairman of the National Advisory Committee for Aeronautics and a member of the Civil Aeronautics Authority.

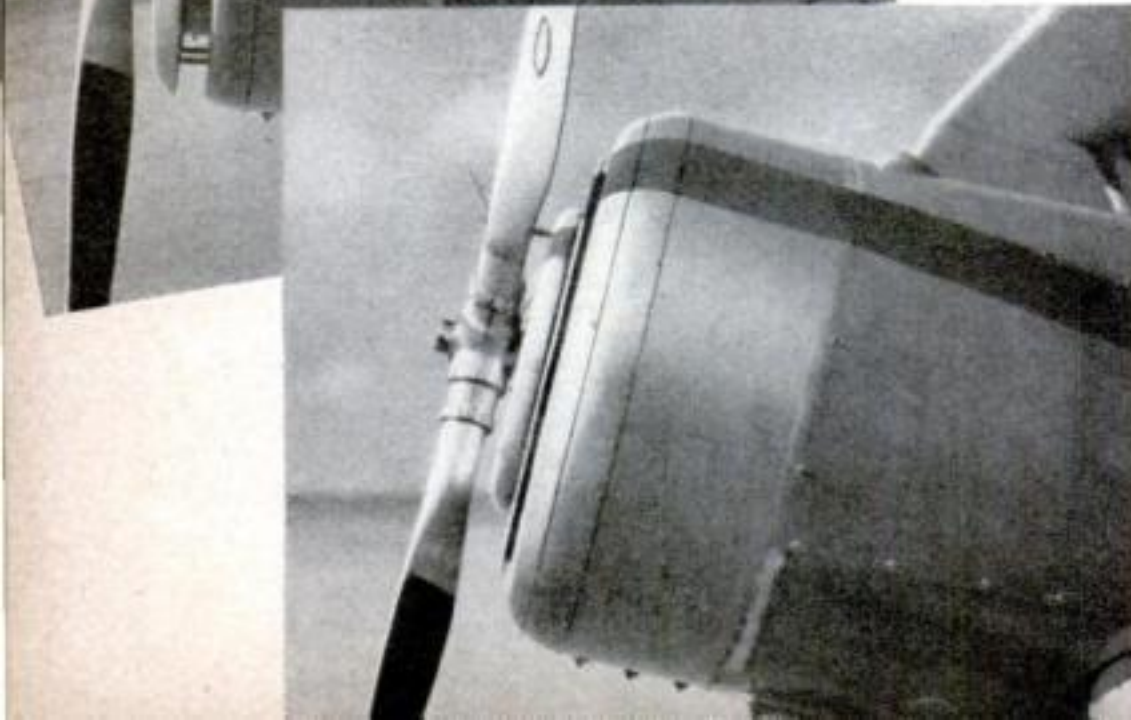
This radically different airplane of tomorrow hasn't been built. As a complete plane, it hasn't even been designed. But it definitely is on its way to becoming a reality of the skyways. All its revolutionary features have proved so successful experimentally that serious work is being continued on their development at the N.A.C.A. aeronautical-research laboratories at Langley Field, Va. All of them have resulted in lessened drag—resistance—and lessened drag is one of the main objectives of air research



Planes of the future will have velvet-smooth wings like this. The arrow indicates apparatus for measuring "drag"



Nose-slot cowling for a radial air-cooled engine as adjusted for low-speed operation. Below, it is set for a high speed



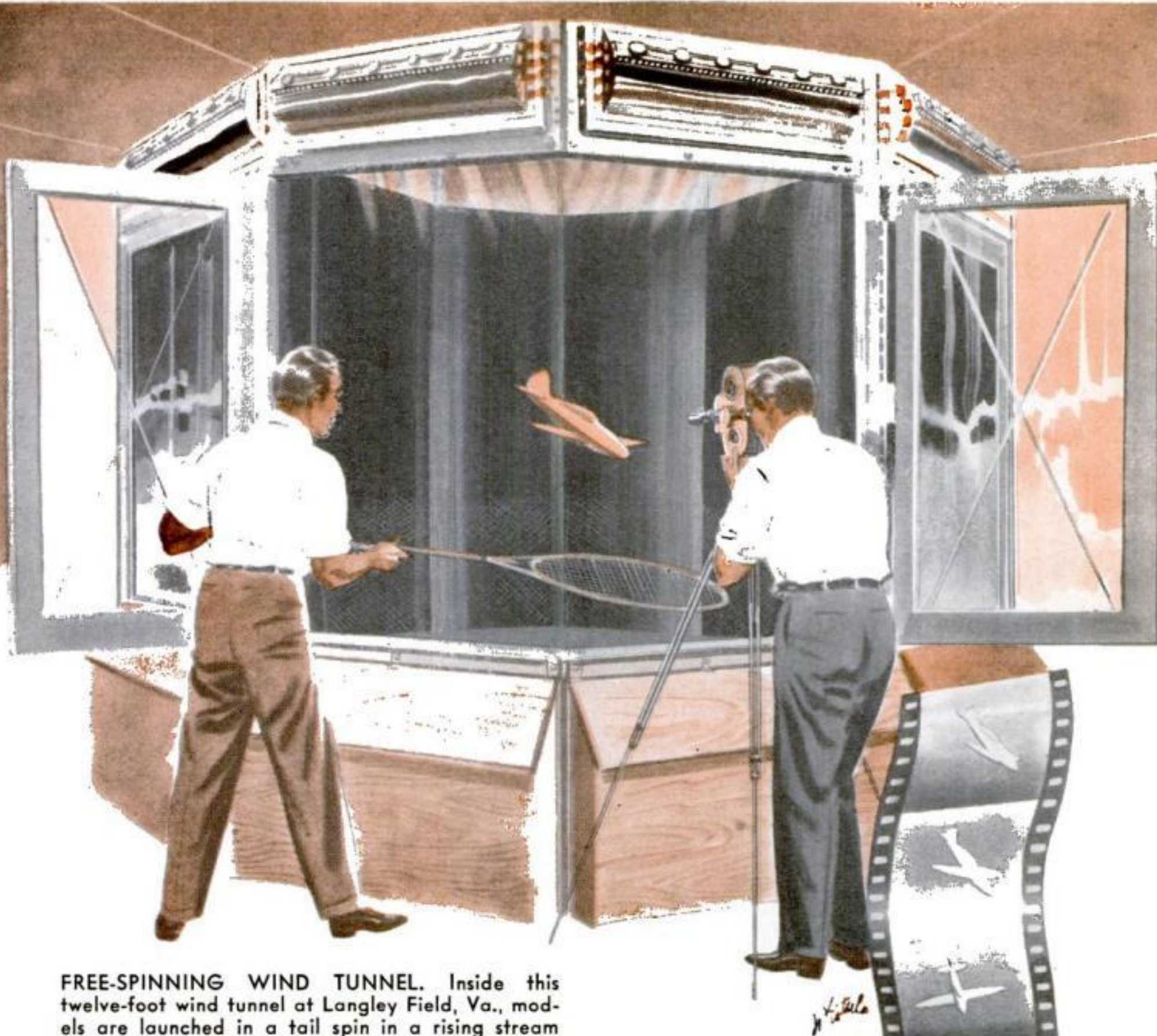
today because it means increased flight speeds without increased power and with decreased operating costs.

Wind-tunnel investigations at Langley Field, a few years ago, resulted in an increase of fifty miles an hour in the speed of multi-engined airplanes by showing designers that the best position for engine nacelles is directly in line with the wings—a discovery which is considered the most important single contribution to the increase of airplane efficiency since flying began.

But even with the nacelles in this most effective position, in a four-engine plane they increase drag by about eight percent. Recent investigations, now being continued at Langley Field, showed that this drag can be practically eliminated by mounting the power plant in the wings and connecting the engines with either tractor or pusher propellers by means of extension shafts. Successful experiments have been made with a "flat" engine designed for in-wing use.

It has been found that engine-cooling apparatus increases the drag by over fifteen percent, and that this drag is greatly lessened by placing the engines in the wings and cooling them with air led through ducts in the wing surface. This method reduces the proportion of the engine's power needed to cool itself from ten to fifteen percent to two or three percent, resulting in increased speed.

Some years ago tests in the twenty-foot wind tunnel at Langley Field led to the development of the N.A.C.A. cowling for radial air-cooled engines which by lowering drag and reducing the power required to overcome the air resistance of the engine increased speed and saved airplane operators millions. Continued experiment has resulted in the development of an im-



FREE-SPINNING WIND TUNNEL. Inside this twelve-foot wind tunnel at Langley Field, Va., models are launched in a tail spin in a rising stream of air. Clockwork sets their controls for recovery

proved cowling which, by means of a disk located in front of the nose and an adjustable nose slot, gives better cooling efficiency for low-speed engine operation on the ground and higher speed in the air.

The first practical step toward the elimination of airplane bodies probably will be a sharp reduction in the size of the hulls of flying boats of the type used in transatlantic service, to reduce water resistance in taking off and drag in flight. Even if the engines were left in their present position, it would be possible to reduce the size of the hull by placing passenger accommodations in the wings of very large planes. Experiments pointing the way toward improvements in the design of seaplane hulls are being carried on in the N.A.C.A. 2,900-foot testing tank at Langley Field, in which large-scale hull models are towed through the water at rates of speed up to eighty miles an hour.

In proportion to its greatly increased size, the airplane of the foreseeable future will have a wing surface considerably smaller than has the plane of today. As a result of constant improvement, airplane wings now carry twice as much weight to the square foot of surface as they did a dozen years ago, and this heavier loading results in smoother flying.

Ingenious advances in wing design also are resulting in

MOVIES SHOW MODELS IN ACTUAL FLIGHT

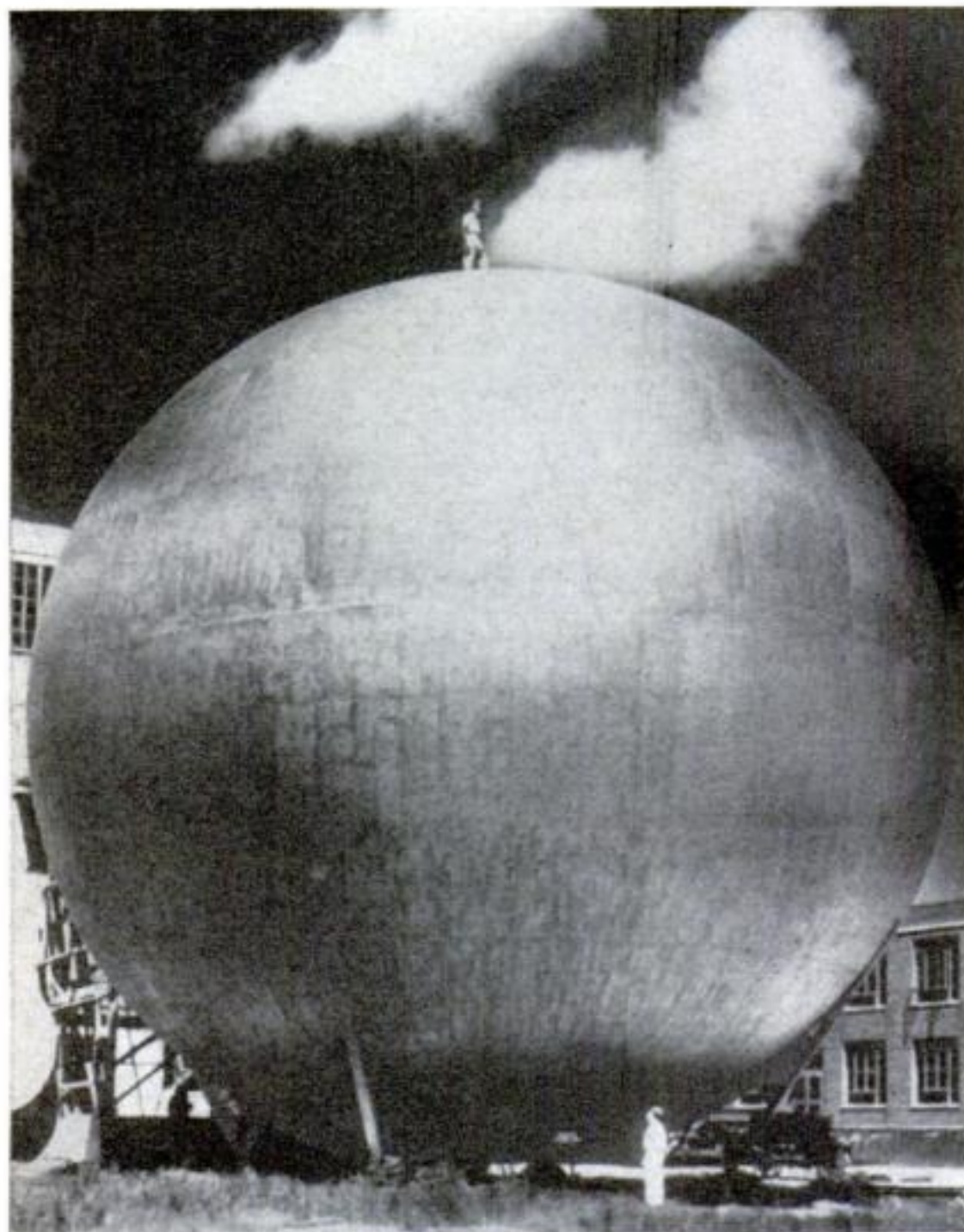
Motion pictures of the model in the wind tunnel show it coming out of the spin, and indicate whether such a plane would be controllable

increased speed without increased power. It is reported unofficially that a new type of wing developed at Langley Field, its design carefully guarded as a military secret, has resulted in the building of a new Army plane with a top speed of 500 miles an hour—which is a lot faster than any other nation's fastest war plane. And speed is of utmost importance to fighting planes.

As airplane speeds progress toward what

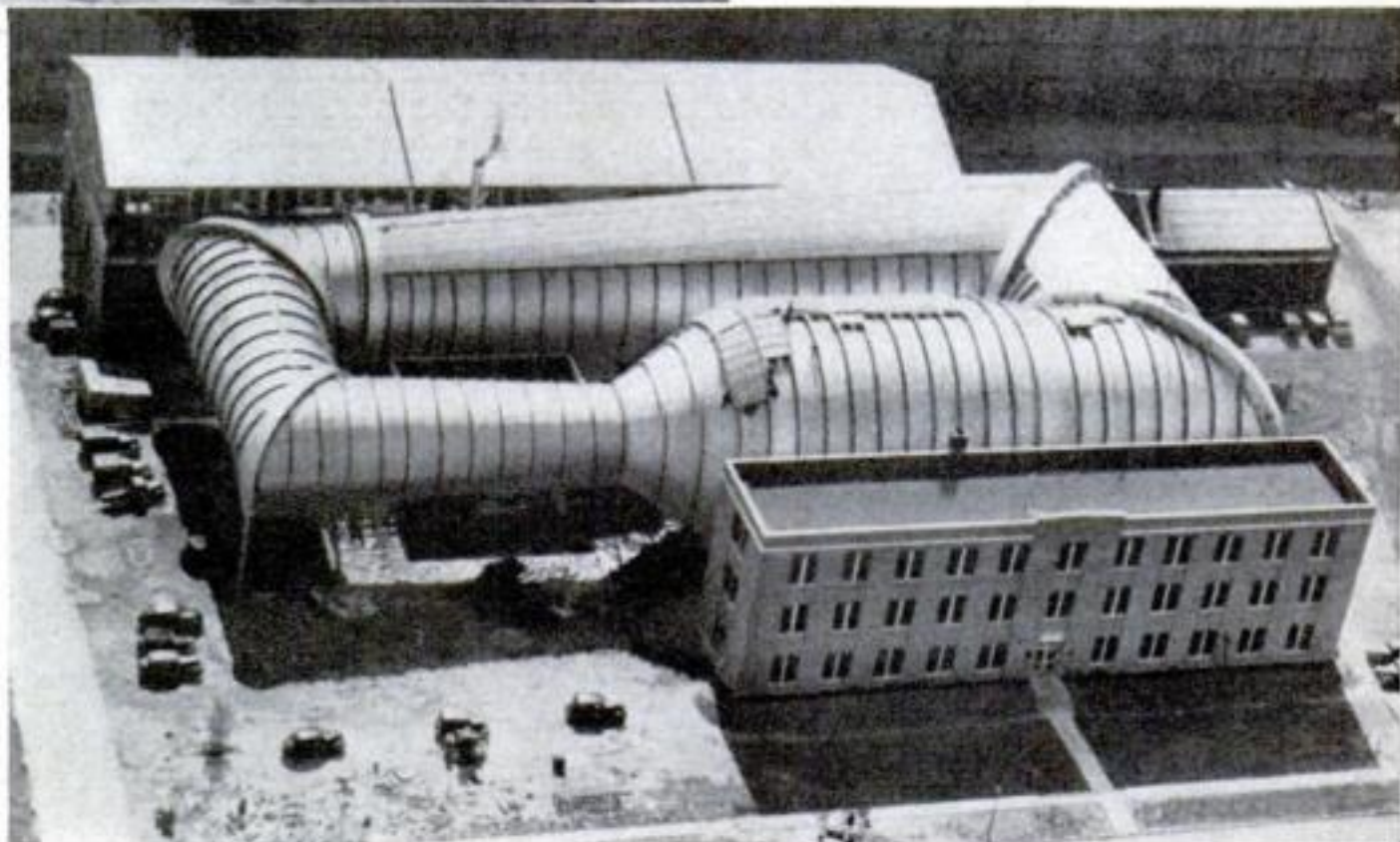
most flight scientists regard as the ultimate of about 600 miles an hour, devices which make possible both safe take-off and landing speeds and extreme speed in the air become increasingly important. Wind-tunnel tests at the Langley Field laboratories a few years ago resulted in the development of the Fowler variable-area wing, which has an extensible surface of the same sectional form as the wing, with a gap between the main wing and the extension which helps to maintain a smooth flow of air over the wing surface. This flap is extended to increase lift in taking off and landing, and retracted to reduce drag while flying at high speed. Such flaps now are used on all high-performance planes. Until recently the Fowler wing gave the highest lift of any of these devices—thirty pounds to the square foot at sixty miles an hour, about double the lift of an ordinary wing. Now tests have shown that a multiple flap of the so-called Venetian-blind type gives a higher lift and lower drag than even the Fowler wing. Experiments with multiple flaps are being continued with highly encouraging results.

Modern design and streamlining of the fuselage and other parts have reduced form drag so much that in the planes of today skin friction often is the cause of more than half of the total drag. N.A.C.A. investigations indicate that it is the little things that will count most
(Continued on page 243)



In this sixty-foot sphere a pressure of two or more atmospheres can be maintained to test models for stability and handling

One of the latest aids to aeronautical research in the United States is the nineteen-foot wind tunnel at the right, also located at Langley Field





"They're a bit tight!" says the new-shoe buyer. So a breaker-inner goes to work. Boy, it's a tough job!

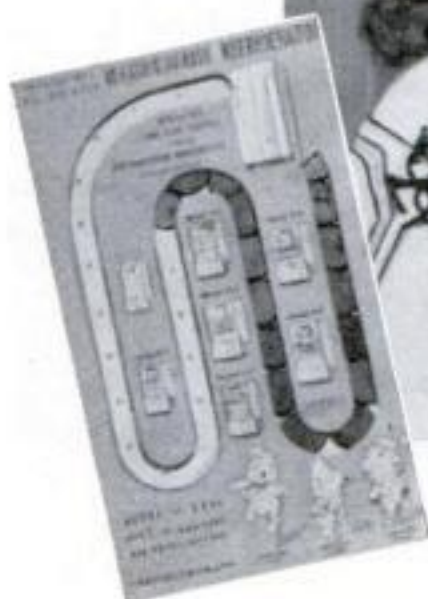
Novel Service Breaks In New Shoes

BREAKING in stiff new shoes for persons with tender feet or for women who want to squeeze a size-eight foot into a size-six shoe, is one of the unique services performed by the operators of a New York City firm. A corps of girls takes on this unenviable task,

while the proprietors busy themselves with other unusual requests of clients, such as filling a midnight call for a violinist to play a sick child to sleep, and first scouting around for and then purchasing two penguins as a present for a pet lover.

Salesman's Aid Shows Refrigerator Savings

A ROBOT cardboard salesman that proves to customers that savings effected by a new mechanical ice box will actually pay for the machine, is now being used in refrigerator salesrooms. Placed in a slot in the card, pennies represent daily savings in operating cost, reduced food spoilage, and quantity buying, gained by substituting a new for an antiquated refrigerator. With the card reversed, the pennies indicate what refrigerator model the savings can buy.



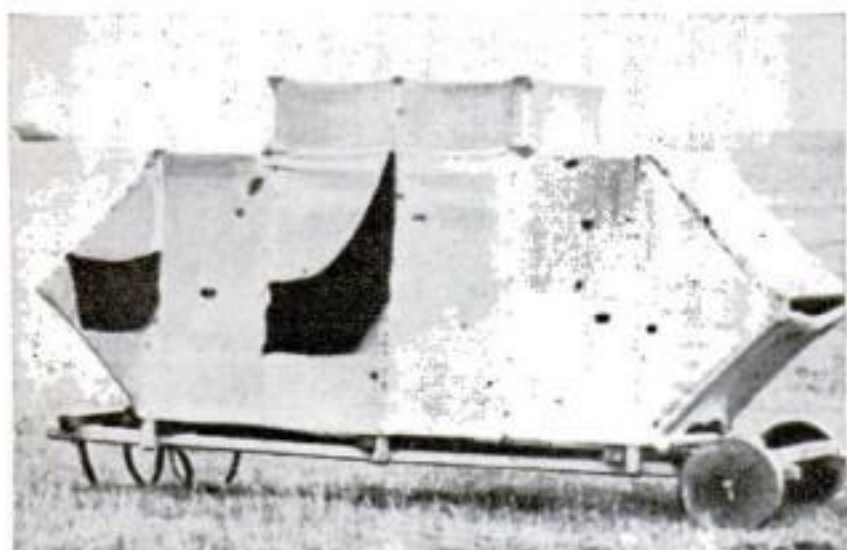
When the card is reversed, pennies representing future savings show what model they could buy



Planes Parked on Noses Save Space

FIFTEEN planes can be parked in the space ordinarily filled by five or six, by the use of the novel stacking method pictured above, employed in a hangar at the municipal air-

port at East Boston, Mass. Plane wheels are blocked and each craft is balanced on its nose with a wooden support protecting the propeller.



Realistic Moving Targets Train Antitank Gunners

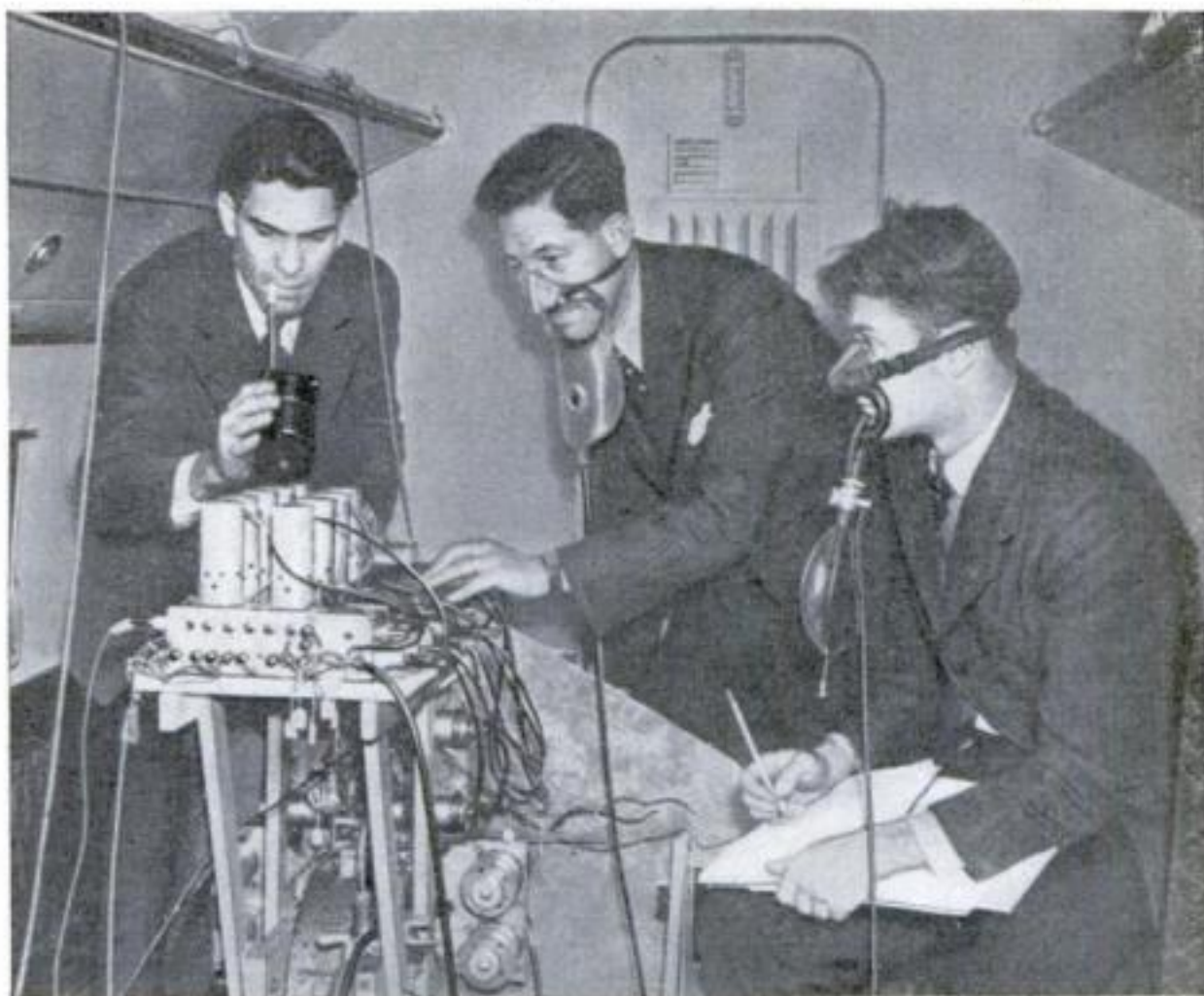
CONSTRUCTED of wood and cloth, and equipped with wheels and ground skids, dummy tanks are drawn across open terrain at a speed of twenty miles an hour to give practice to British antitank-gun crews. Pierced by numerous direct hits, a dummy tank is pictured at the left after practice.



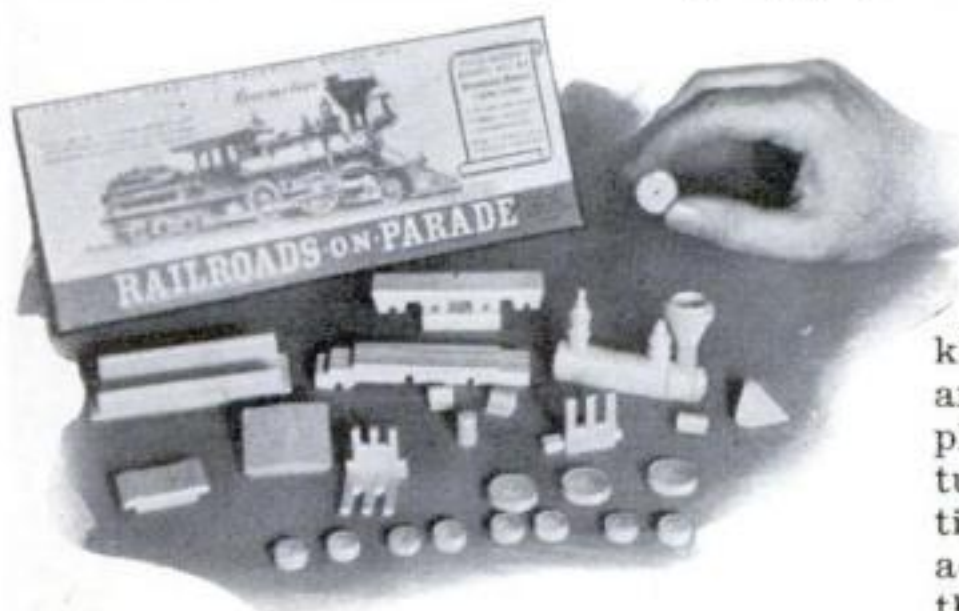
Towed across a field, the dummy tank (inset) offers a practical target for antitank-gun training

Airplane Is Cosmic-Ray Laboratory

PROBING the mysteries of cosmic rays, the strange and powerful radiations that bombard the earth from outer space, scientists have descended to subterranean tunnels and climbed to mountain-top laboratories in their efforts to ferret out the hidden secrets of the rays. Recently a new locale was tried when three experts installed delicate cosmic-ray-detecting apparatus in a plane for a high-altitude flight. Wearing oxygen masks, the experimenters put their apparatus into operation at an altitude of 29,000 feet. Dr. Arthur H. Compton, cosmic-ray authority, aided them by radio from the ground.



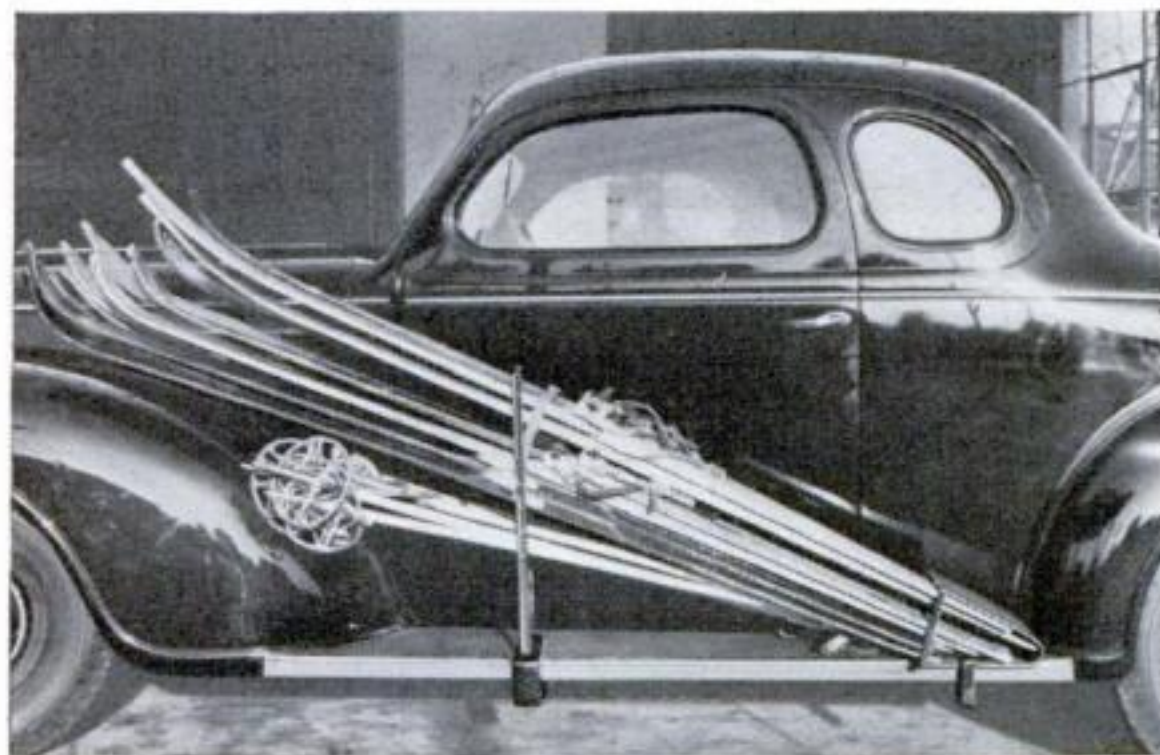
Breathing oxygen, three scientists study cosmic rays nearly six miles up



Ready-shaped parts make the models easy to build

Model-Train Kits Trace Railroading's History

ALL the materials required to construct wooden models of old-time railroad locomotives are now available in kit form. In addition to wheels, stack, boiler, and other shaped parts, the kit includes supplies of sandpaper and glue. The model pictured at the left is the J. W. Bowker locomotive which was built in 1875 and played an active part in the Nevada mining boom of that time. Kits for modern as well as historic engines are available.



Six pairs of skis and their poles are handled easily by the carrier

Ski Rack Fits on Car Running Board

SIX pairs of skis and ski poles can easily be carried on the running board of an automobile with an inexpensive carrier now available. Skis are placed at an angle with their heels on the running board near the rear fender and their tips facing forward over the front fender. They are held in place by vertical metal arms that are fastened to the running board by hand-screw clamps.

Merry-Go-Round

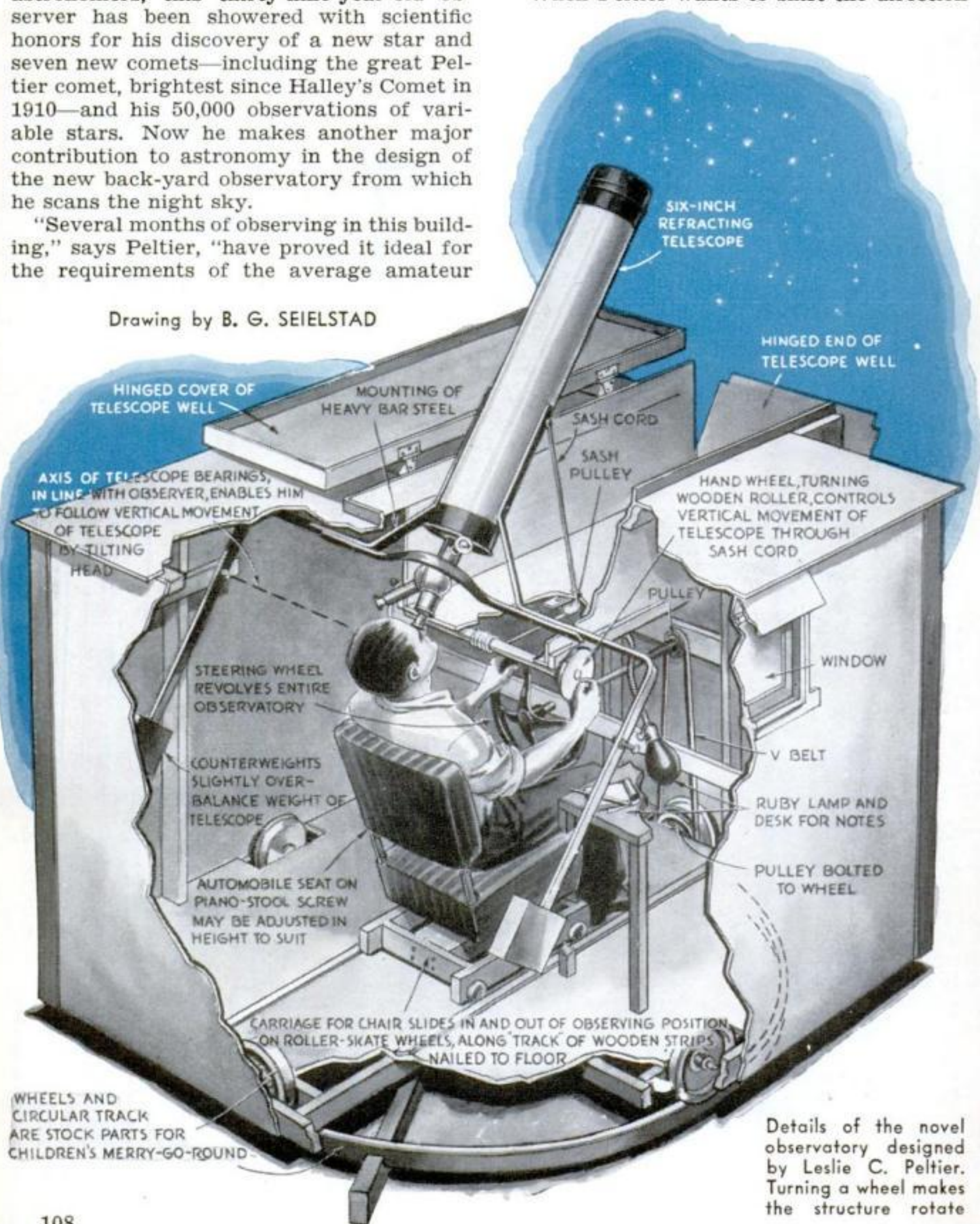
BELIEVED to be the only one of its kind in the world, a novel "merry-go-round" observatory has been designed and built by Leslie C. Peltier, of Delphos, Ohio. One of America's foremost amateur astronomers, this thirty-nine-year-old observer has been showered with scientific honors for his discovery of a new star and seven new comets—including the great Peltier comet, brightest since Halley's Comet in 1910—and his 50,000 observations of variable stars. Now he makes another major contribution to astronomy in the design of the new back-yard observatory from which he scans the night sky.

"Several months of observing in this building," says Peltier, "have proved it ideal for the requirements of the average amateur

astronomer." As well as it suits his six-inch refracting telescope, he declares it could be still better adapted to any of the thousands of homemade reflecting-type instruments in use throughout the country.

When Peltier wants to shift the direction

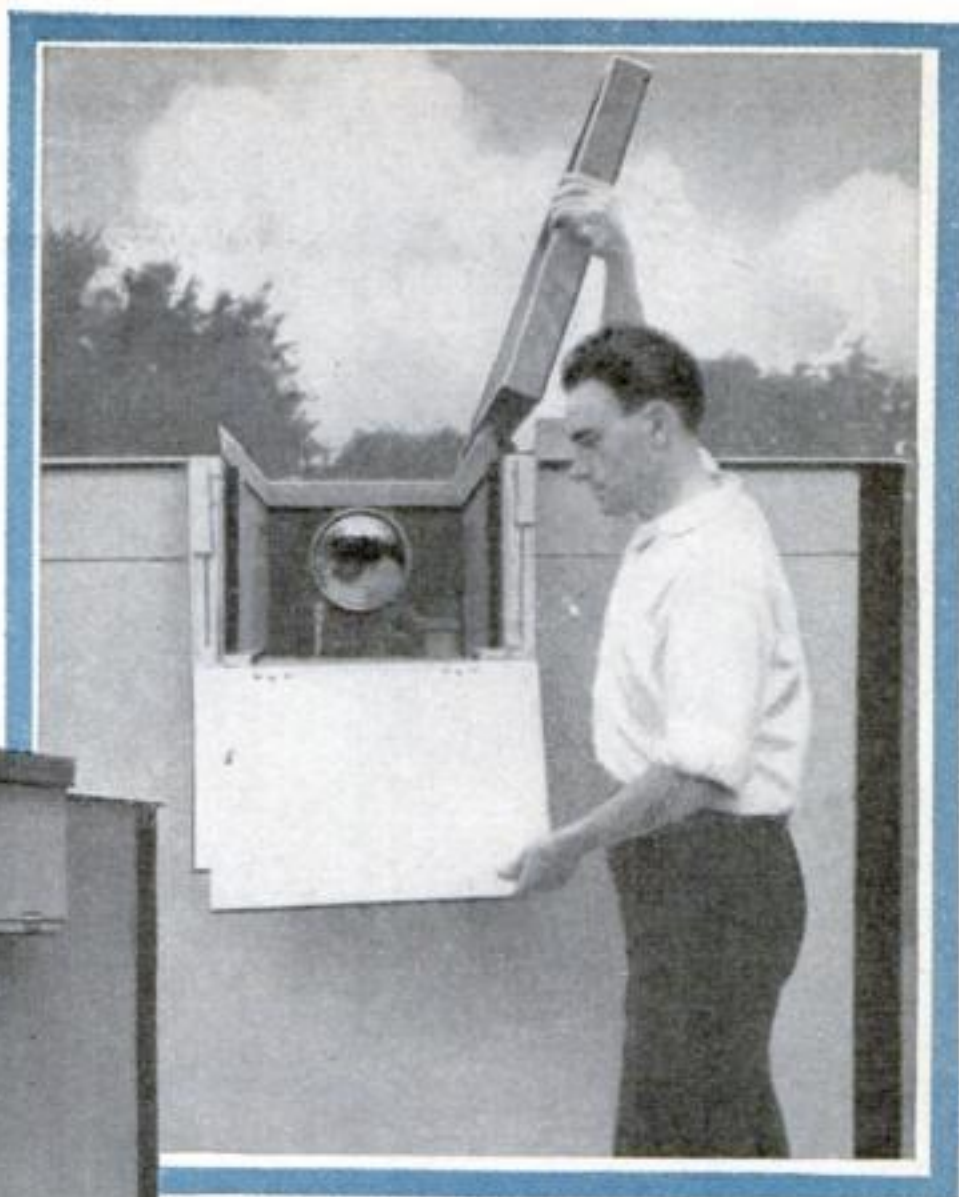
Drawing by B. G. SEIELSTAD



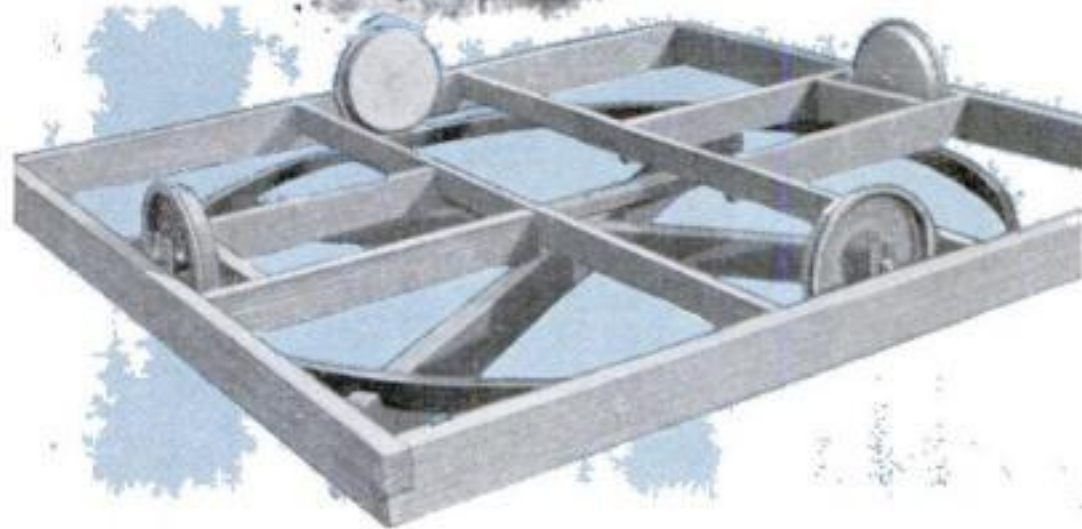
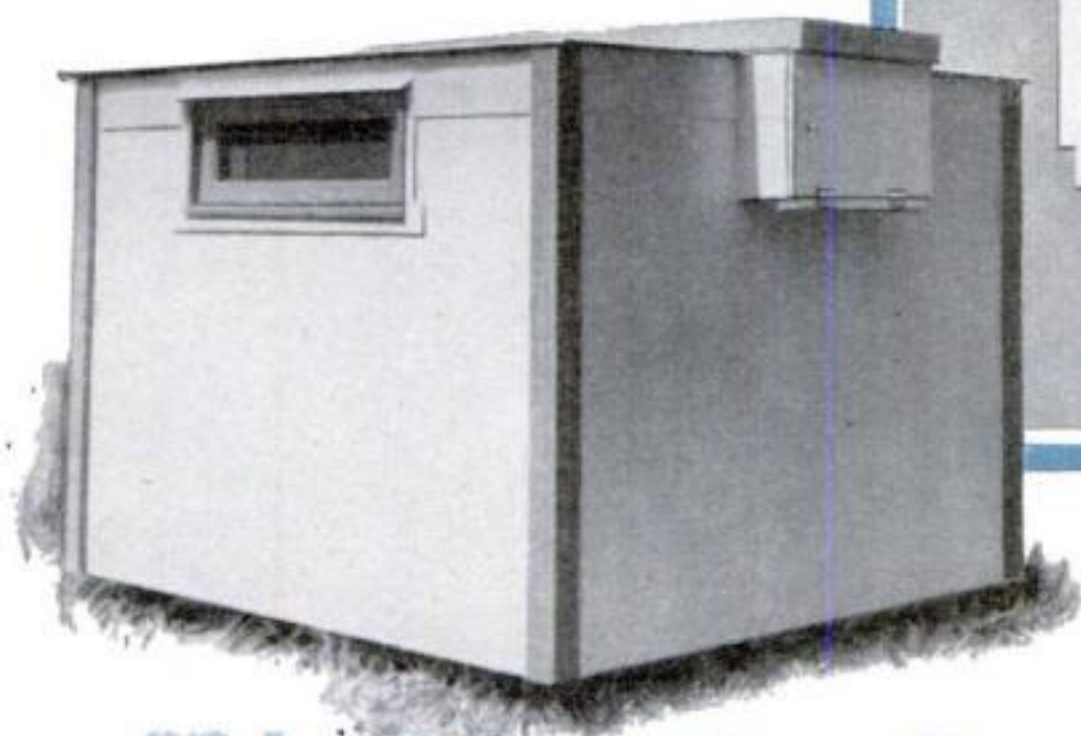
Details of the novel observatory designed by Leslie C. Peltier. Turning a wheel makes the structure rotate

Observatory

ACE AMATEUR STARGAZER
STALKS COMETS WITH A
NOVEL TELESCOPE MOUNT
HE BUILT FOR HIMSELF



Peltier shows how the lid is lifted from the telescope well. The inside of the structure is painted a dead black to minimize light reflection



Exterior of the midget observatory, and the base framework with circular track. Wheels are from a child's merry-go-round

close to the opening that fully a tenth of the starry scene is visible—a great advantage to students of meteors, or to those who like to see a whole constellation to find their way about in the sky. At the right hand of the observer stands a convenient desk, illuminated by a ruby lamp. To minimize reflections, the whole interior is painted dead black.

Midget in size, Peltier's home-made observatory measures only six feet square and five feet high.

By exercising his ingenuity, the

designer found his materials easy to obtain. The four roller-bearing wheels and the circular track on which the building rotates are stock parts for a children's merry-go-round. A pair of water-pump pulleys, one bolted to a wheel and the other mounted on a pipe welded to the steering wheel, provide a V-belt drive. A central bearing admits an electric cord for the lamp and, in severe weather, for an electric heater. Structural items include a base framework of two-by-fours bolted together, a floor of plywood, siding of pressed-wood composition board, and a sheet-metal covering for the roof.

of his telescope, he turns a steering wheel, and the whole observatory revolves. A small control wheel in his other hand raises or lowers the instrument. Thus, sitting in a comfortable upholstered chair, he can quickly sight upon any object in the heavens. As the telescope moves from the horizon to the zenith, its eyepiece describes an arc that he can follow merely by tilting his head, thanks to clever placing of the bearings on which the counterweighted framework pivots.

In a conventional astronomical observatory, the observer sees only a narrow strip of the sky, but in Peltier's design he sits so

of his telescope, he turns a steering wheel, and the whole observatory revolves. A small control wheel in his other hand raises or lowers the instrument. Thus, sitting in a comfortable upholstered chair, he can quickly sight upon any object in the heavens. As the telescope moves from the horizon to the zenith, its eyepiece describes an arc that he can follow merely by tilting his head, thanks to clever placing of the bearings on which the counterweighted framework pivots.



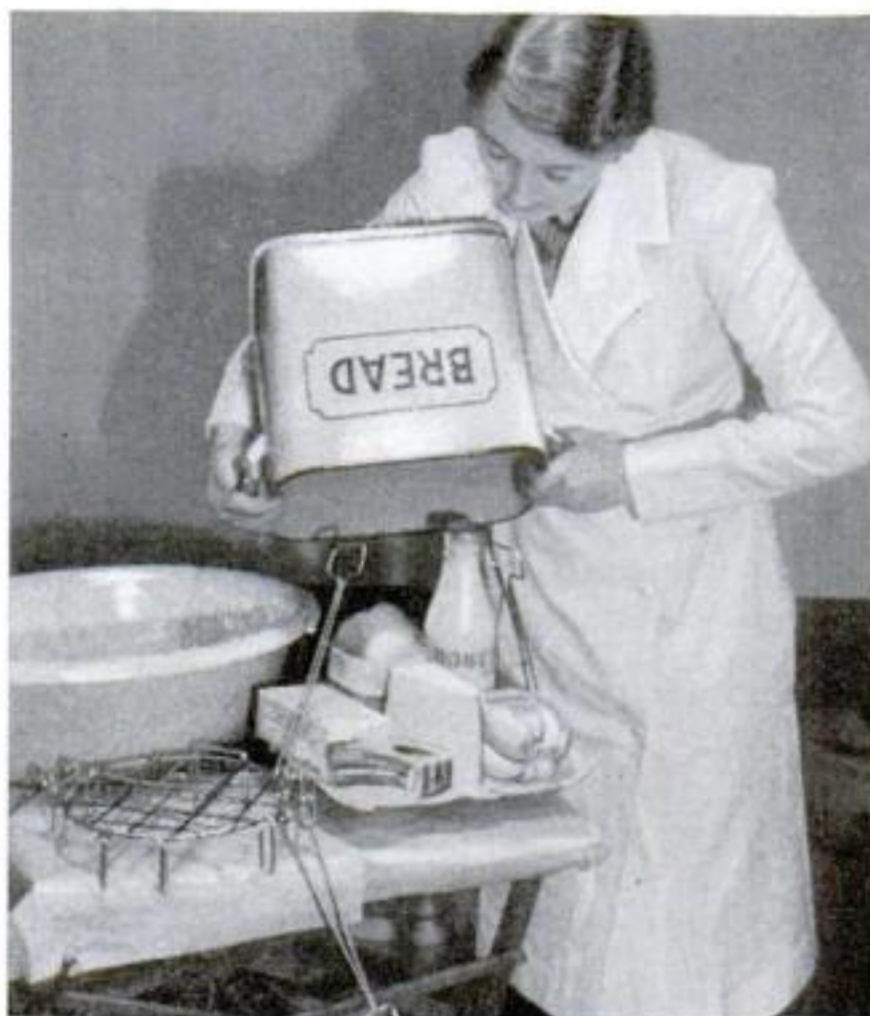
Big Chemist's Retort Built for Movie

FOUR feet in diameter and more than five feet high, what is believed to be the largest chemist's retort ever made was fashioned from a new plastic material for use in a

current motion-picture scene. In the film, a magician "creates" a full-grown woman inside of what appears to be an empty glass retort. The scene is shown above.

Rack Protects Food from Poison Gas

SUPPLIES of food and drink can be protected from contamination by poison gas in case of wartime air raids by a novel and inexpensive device developed by M. Jaffe, a British inventor living in Liverpool. Food is placed on a raised wire platform and covered by an inverted mixing bowl, bread box, roasting pan, or other nonporous kitchen utensil. By means of two long wire handles, the covered food is then lowered into four or five inches of water standing in a basin or in the kitchen sink. The water forms a perfect air lock inside of the improvised food protector, making it impossible for gas fumes to seep in. With the device, it is said, one minute is sufficient time to protect a supply of food which could be consumed without fear of contamination or pollution after the danger of the gas raid had passed. Larger units could be used for protecting food in hospitals and other institutions.



Food on the rack is set over water and then covered

Pits Conceal Antitank Guns



German soldiers covering a pit to conceal an antitank gun. The pit not only conceals the gun crew but protects them from shrapnel

AS A MEANS of protection against tank attacks across open terrain, German military authorities are reported to have constructed a series of sunken, antitank-gun nests in flat areas along their western frontier. The tops of the pits are camouflaged with a cover of brush and leaves, as shown above, so that enemy tanks will be lured unsuspectingly within effective gun range.



Self-Cleaning Comb Curls Hair, Too

SELF-CLEANING properties are attributed to a novel new comb which has specially designed teeth that extend on one side of the comb nearly to the back edge, as shown in the magnifying-glass photograph above. In addition, the makers claim that the comb tends to curl straight hair and to increase the life of permanent waves.

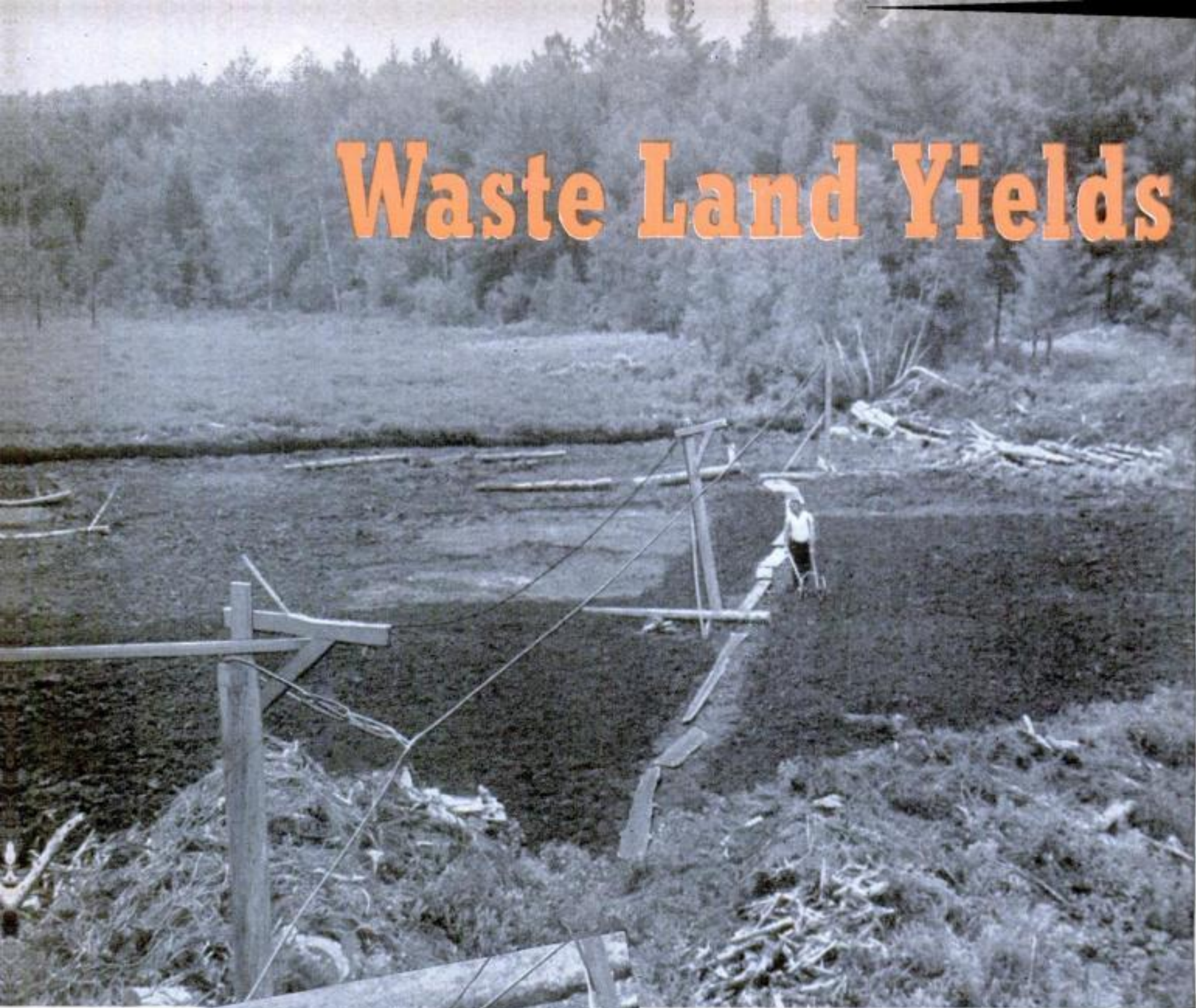
Liquor Flavors Growing Melons

FLAVORING growing melons with port wine and cognac is the novel horticultural experiment being tried on the Yonkers, N.Y., estate of Samuel Untermyer, New York lawyer. Bottles of the beverages used are held in a tipped position by wire frames stuck into the ground near the melon vines. A wick leading from each bottle is introduced into the fruit through a slit made in the plant stem. Thomas Quinlan, a gardener on the estate, is shown examining the liquor-fed melons, which are said to be given a superior flavor.



Wicks feed the liquor from bottles into openings in the plant stems

Waste Land Yields



View of the curious peat-moss mine accidentally discovered by David M. Perkins on the outskirts of Center Barnstead, N. H. Perkins is shown at left shoveling the valuable product from his one-man mine into a conveyor that carries it to his processing plant. Below, a sample as it is spaded from the mine



Treasure in Peat Moss

By CARL WARDEN

TEN acres of waste land, on the outskirts of a small New England village, have become the scene of a singular mining boom. With a hand cultivator, a barnyard conveyor, and machinery run by a discarded automobile engine, David M. Perkins, of Center Barnstead, N. H., has excavated more than 200 tons of "pay dirt" from the spot. His treasure is neither gold nor gems nor granite. It is brown, spongy earth. For, his waste-land plot is one of the few peat-moss mines in America.

This material, the product of centuries of slow decay, is so valued by gardeners and poultrymen that more than \$1,200,000 worth is imported annually. Virtually all the peat moss used in America comes from abroad. With the war interfering with shipping, the discovery of new domestic sources of supply is of special interest.

A curious chain of circumstances led Perkins to the discovery of his mine. Two years ago, he and his father purchased the tract on the edge of Center Barnstead for the purpose of establishing a commercial trout pool. They intended to excavate the hollow, turn it into a lake, stock the water with game fish, and then charge anglers a fee for fishing there.

In preparation for the digging, they began clearing the site of bushes. The work had not progressed far before they noticed a peculiar thing. The ground was so spongy that fairly large bushes could be pulled up by hand. Per-

kins dug down. He found a solid layer of sphagnum moss ex-

tending as far as three feet below the surface. Underneath was brown, spongy material unlike anything he had ever seen. He scooped out some and sent it for analysis to the state university at Durham, N. H.

A week or so later, one of the scientists from this institution drove down to Center Barnstead. There are only 400 inhabitants in the village and he had little difficulty finding Perkins. He reported that the samples Perkins had sent in were high-grade peat moss. He was interested in examining the site where the peat had been found. Together, the men dug and made borings. In some places, they found, the peat moss descended for more than twenty feet.

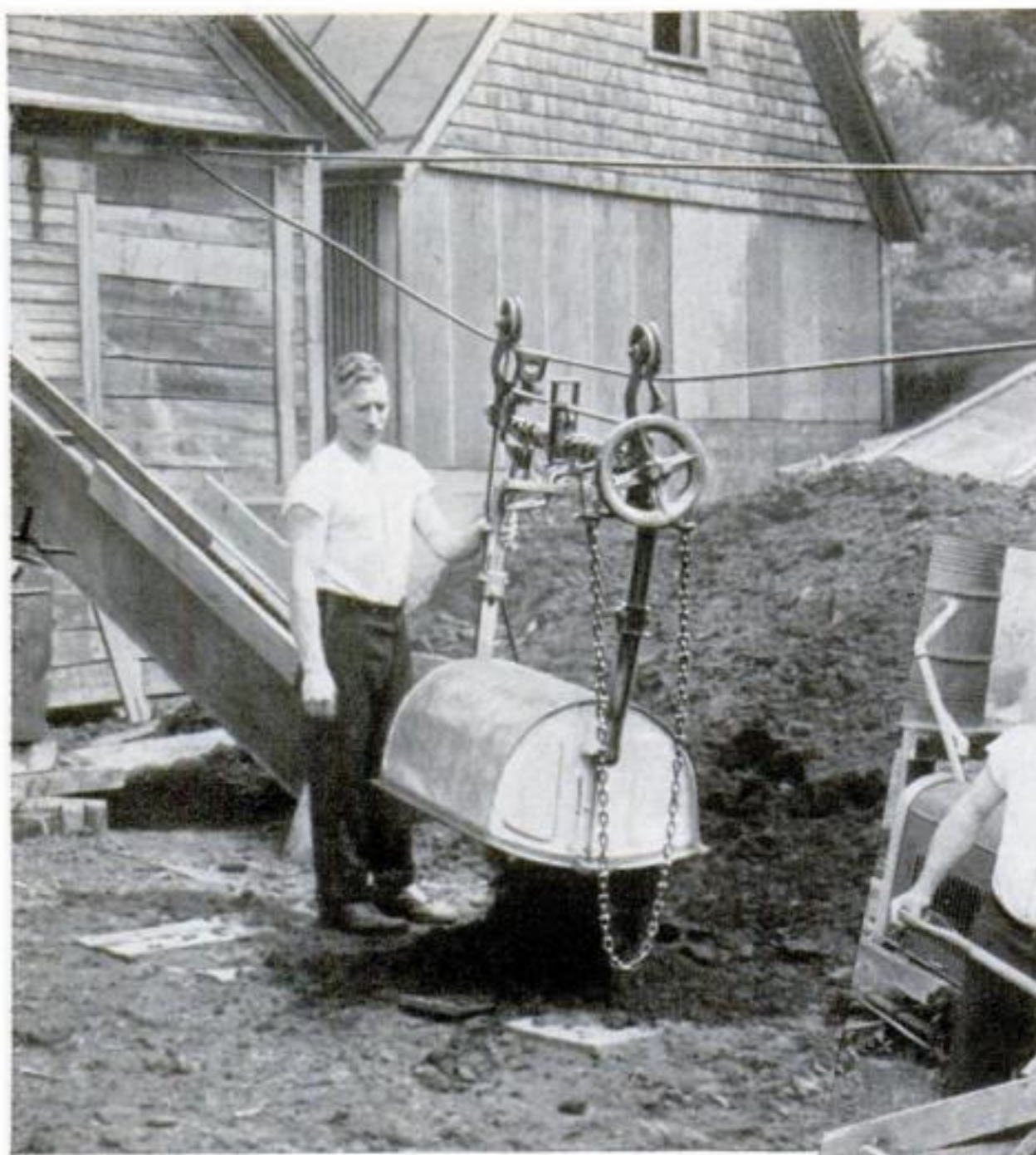
As a double check, Perkins forwarded other samples to the U. S. Department of Agriculture, in Washington, D. C. The report that came back indicated that his peat moss was ninety-eight-percent pure organic matter. As no stream ever flowed through the hollow, there is virtually no foreign matter, such as sand or gravel, in the peat.

Among its many uses, peat moss is em-

**Planning a
Fishing Pond, an
Observant New England
Villager Stumbled Upon
a Curious Field of
"Pay Dirt"**

Top layer of the moss that goes down to a depth of twelve feet





Dumping the raw product out of the conveyor that runs back and forth from the mine. From here it will be carried indoors on an endless belt, pressed, dried out, and ground, to ready it for use

The endless-belt conveyor. With all the rest of the plant's machinery, it is driven by a discarded auto engine



ployed for improving the quality of garden soils, in forming a top-dressing for golf-course greens, and for providing an absorbent layer on poultry-house floors in winter months. The New Hampshire peat could be burned, like that of Ireland, but it is more valuable for other purposes.

Tests have shown that peat is an efficient insulating material and that peat dust is an exceptionally effective deodorizer. And, other experiments have indicated that peat formed from sphagnum moss has absorbent and antiseptic qualities which make it an excellent substitute for medicated cotton in surgical dressings.

Nobody knows how many centuries have passed while the Center Barnstead hollow has been filling with its successive layers of moss. So far, in his one-man mining operations, Perkins has opened up only about three quarters of an acre. More than nine tenths of his store of peat moss remains untouched. And, where operations have begun, only a thin upper layer of the brown material has been removed.

In "working" his mine, Perkins first pushes a hand cultivator back and forth across the open space, ripping up the spongy peat. Then, he shovels the loose material into a conveyor supported by an overhead

cable, and transports it to a metal-covered, barnlike processing shed. Just outside the building, the peat is dumped in a great mound. Later, as it is needed inside, it is shoveled onto an endless-belt conveyor which carries it through a window and into a shredding machine, the first of several mechanisms which prepare the material for market.

In one corner of the long shed, a gasoline engine—obtained from a junk automobile—thunders away, supplying power for all the machines in the one-man plant. It moves the conveyor which brings the peat into the building, it whirls the spinning arms of the shredding machine, it operates the presses that remove excess moisture, and, finally, it powers the pulverizers that turn part of the peat moss into powder for special purposes. The final product, cleaned and prepared for market, is sold in sacks. Wholesale, the peat moss brings twenty dollars a ton—or quite a profit for "worthless land."

Fashion Plates Adopt Armor Plate



A Londoner trying on the latest in bulletproof vests. Right, being measured for a steel-lined bowler

MEN'S shops in London are now stocking a new line of merchandise for sale to customers who want special protection during possible enemy air raids. In their clothing departments, the stores are offering bulletproof waistcoats, or vests, in all sizes

and in a wide variety of styles. Hat departments are keeping pace by supplying the traditional English bowler, or derby, specially fitted with a steel lining that makes it as protective against flying fragments as the metal helmets issued to soldiers.



Fred Montgomery checking new additions to the University of Kansas library of rare movies

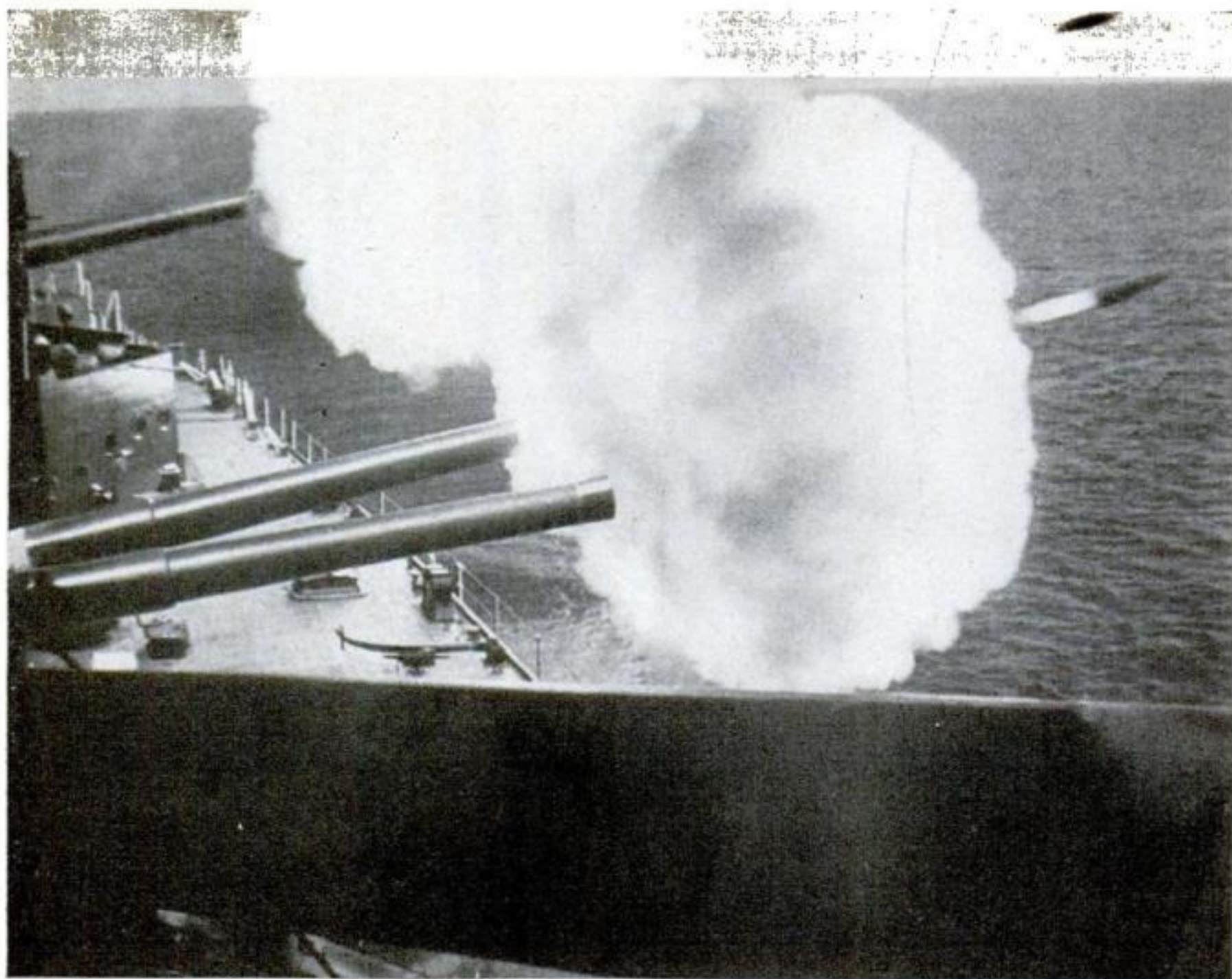
Rare Motion-Picture Films Form Bookless Library

A **BOOKLESS** library that is stated to be the largest of its kind in the world is maintained at the University of Kansas, at Lawrence. Instead of books, the library contains prints of old motion-picture films. In the photograph at the left, Fred Montgomery, who is in charge of the collection, is shown looking over part of a recent shipment of 250,000 feet of film.

Traveling Case for Bottles

MADE of a suedelike material, a new bottle protector was designed especially for travelers. Built for medicine and cosmetic containers, the bottle bag has a perforated lining filled with absorbent gauze and cotton, which not only cushions the bottle to prevent breakage, but also soaks up any liquid that may leak out while the bottle is packed away.





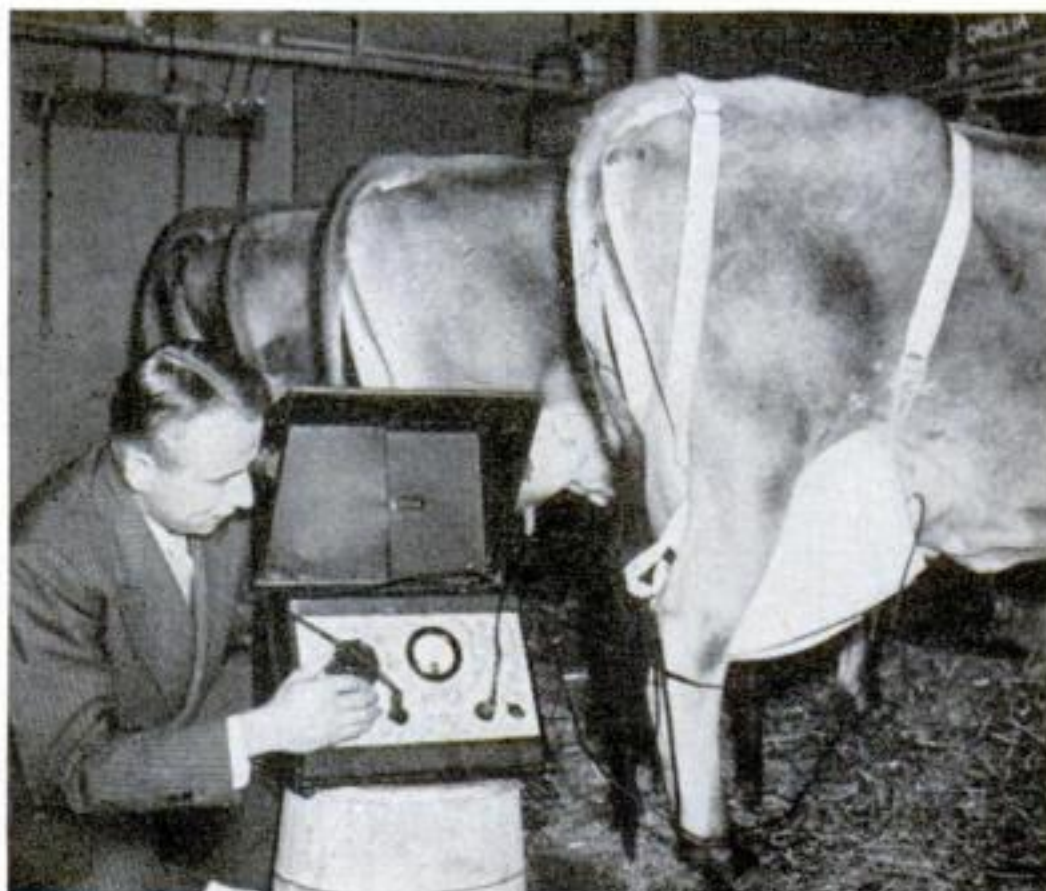
Camera Catches Shells from Big Guns

SHELLS fired from the big guns of a British battleship during gunnery practice off Portsmouth, England, not long ago, were caught by a camera just as they left the gun muz-

zles, as shown in the remarkable photograph reproduced above. One shell is visible at the center right of the picture, and another at the top right.

Cows Get Treatment by Heat Radiation

CATTLE are given special heat treatments for the cure of various ills by means of an electric-therapy machine developed for animal use by Dr. E. D. Hildreth, professor of bacteriology at Ohio State University at Columbus. Plugged into an electric outlet, the apparatus creates short-wave radiations which are passed through an ailing part of the animal's body. Two electrodes are strapped on opposite sides of the affected part and the radiations pass between them, creating a soothing and curative internal heat. Dr. Hildreth is pictured at the right demonstrating the machine on a cow.



Dr. E. D. Hildreth demonstrating his heat treatment for cows

Inventor Hides Secret of "Death Ray"

PIGEONS on the wing instantly killed by death rays from a machine four miles away—that is the feat reputedly accomplished by a deadly apparatus developed by Dr. Antonio Longoria, of Cleveland, Ohio, who recently announced that he had deliberately destroyed the lethal machine for the good of humanity. The Cleveland inventor declared that he had stumbled on the deadly rays while experimenting in the treatment of cancer with high-frequency radiations. The action of the fatal rays, he declared, is painless and they work by changing the blood into a useless substance, much as light transforms silver salts in photographic processes. Before a group of scientists, it is reported, he once demonstrated that the radiations would kill



Dr. Antonio Longoria, who vows never to reveal his secret of the "death ray"

rats, mice, and rabbits, even when the animals were incased in a thick-walled metal chamber. The rays, Dr. Longoria believes, could kill human beings just as easily.



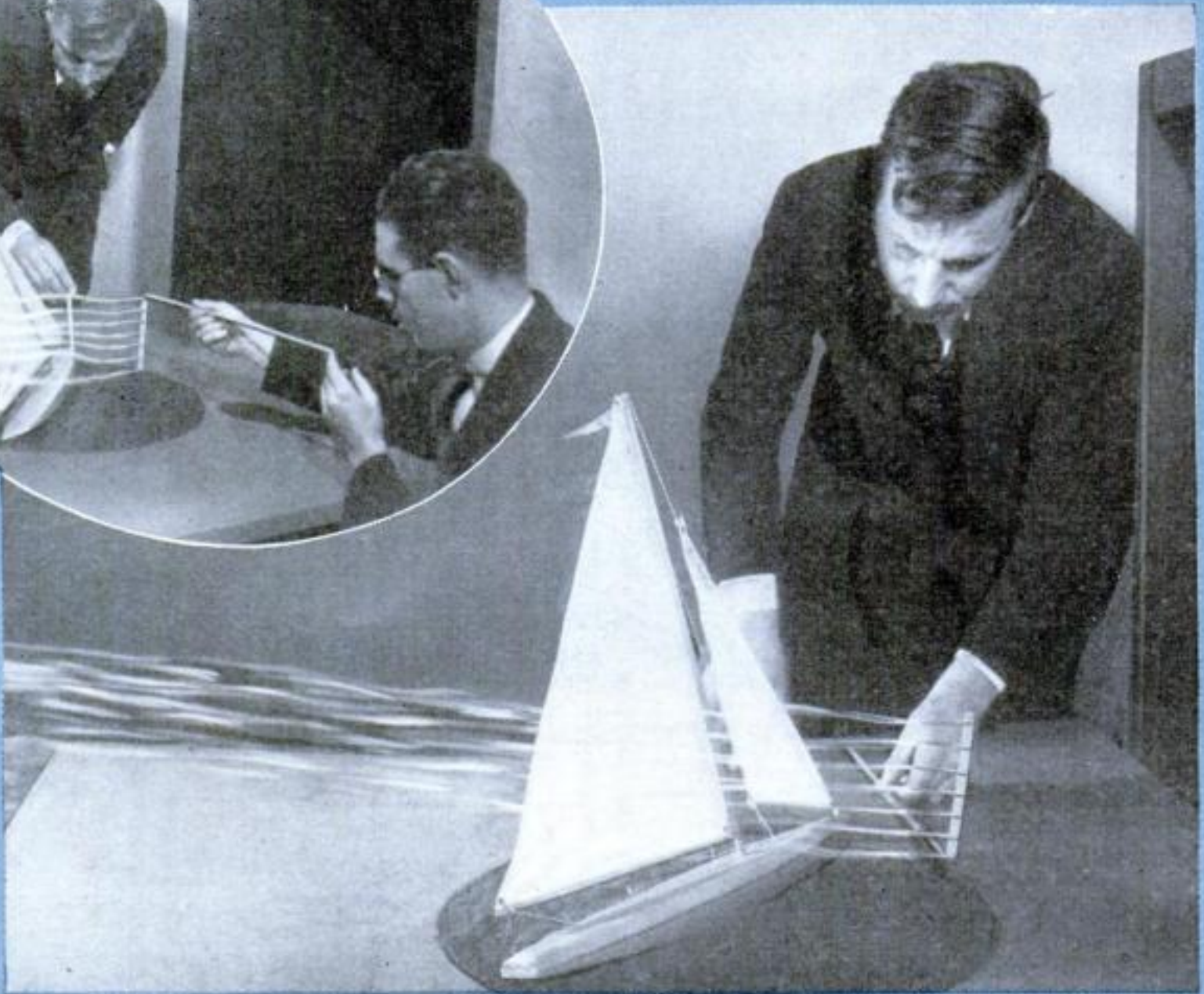
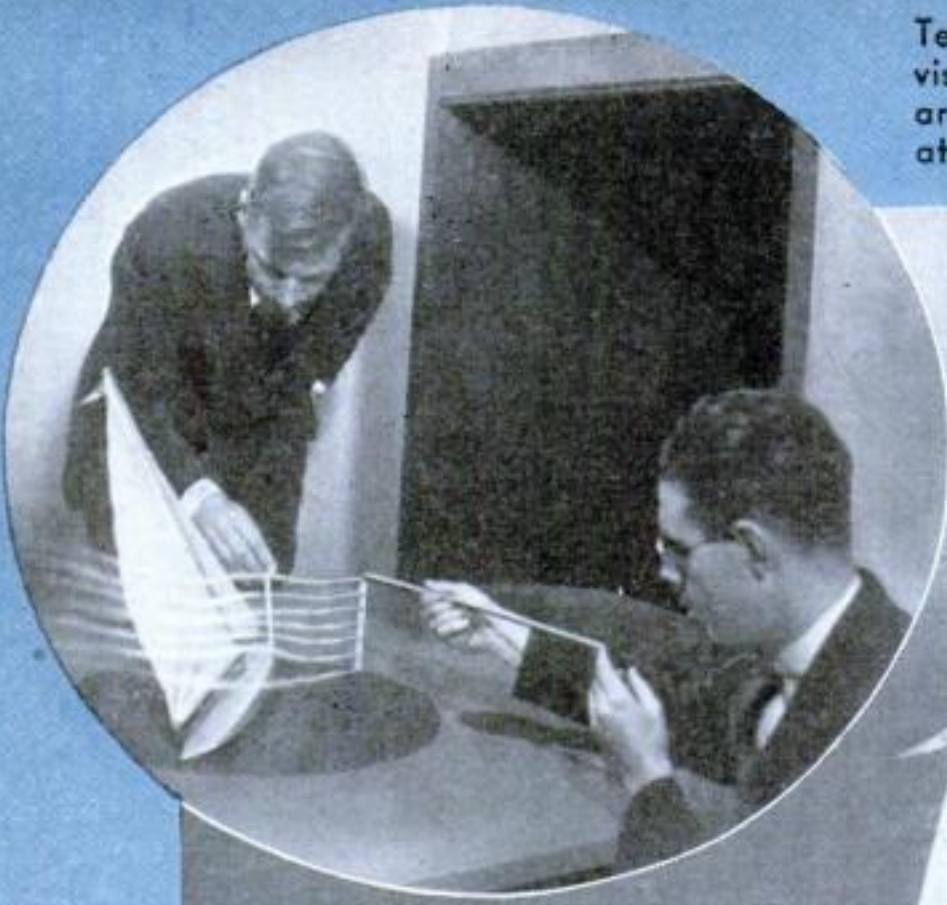
Water-Filtering Plant Is Portable

LIGHT enough to be carried by one man, a portable filter outfit recently introduced is designed to insure a clean, clear, and uncontaminated supply of water to woodsmen, surveyors, explorers, and other groups who must rely on water of unknown quality. Fitted with a hand pump for drawing water from a river or lake, the apparatus will work successfully with practically any type of filter material to deliver five gallons of filtered water a minute.



Portable filtering plant in use. A hand pump draws water from a stream or lake. Left, how the forty-pound outfit can be carried

Testing sailboat models with smoke. Below, visible air streams striking a rounded hull are deflected into the sails. In the model at left, sharp deck edges waste wind power



Smoke Tests Guide Sailboat Design

GREATER sailboat speeds may be possible by rounding the deck edges of the craft, according to novel wind tests made at the Case School of Applied Science,

Cleveland, Ohio. Controlled streams of air, made visible by the introduction of smoke, showed that rounded deck edges directed more wind into the sails.

Wire Loops Hold Visor on Ski Cap

HELD in place by tiny wire loops that resemble hairpins, a visor developed by a California ski enthusiast is easily attached to the peak of a ski cap. Made of a green celluloid material, the visor not only affords protection from the glaring rays of the sun, but when pulled down, prevents wind from rushing directly into the eyes of a skier as he travels downhill at top speed. When not needed, the visor may be pushed up out of the way, or it can be removed and kept in a pocket if desired.



New ski visor attached to a cap. It is fastened in place with wire loops like hairpins, as shown at the left

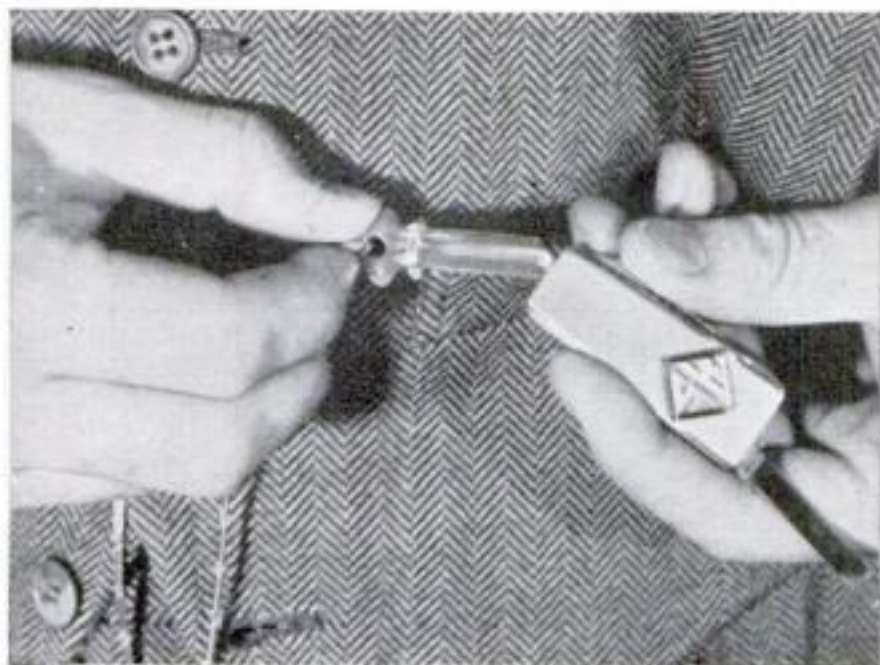
Stilt Bike Gives Second-Story Ride

BICYCLE riders will have no trouble in making their way up in the world if they construct a stilt bicycle like the odd one pictured below. Built by Bryant Guthrie, a telegraph messenger boy, the odd vehicle was made from the frame of an old bicycle and lengths of pipe welded together at the joints. One long pipe runs down from the handlebars to the bottom of the frame, where it is connected to two shorter iron rods to form the steering mechanism. A cross-bar on the rear fork of the frame makes a convenient spot for any hitch-hiker to stand while getting a ride on the queer vehicle.



Bryant Guthrie on his "stilt bike." The standard bike shows its height

With the help of a friend, Guthrie adjusts the long sprocket chain



The key slips easily into the end of the knife

Knife is Holder for Key

NAIL FILE, knife, and a key blank that can be cut to fit any lock, are combined into a single pocket unit now on the market. The key slips into one end of the knife, one blade of which serves as a nail file as illustrated in the picture at left.

WHAT did you like best in this issue of POPULAR SCIENCE MONTHLY? Your answer may win a prize. See "Our Readers Say" for details of this interesting letter contest.



MAKING OF AN Army Flyer

PART II



Drop-testing parachutes with weights is a regular practice to safeguard flyers' lives

CADET RICK JONES LEARNS ABOUT NIGHT FLYING AND HAS HIS FIRST EXPERIENCE WITH THE "JEEP"

THE night was black and moonless, but as Flying Cadet Rick Jones sat at the dual controls of his sleek Army BT-9 monoplane, it looked to him as if he could reach up and pick a handful of stars right out of the clear Texas sky.

His preliminary Air Corps training behind him, Rick was now a student at Randolph Field, the great university at which the U.S. Army prepares men to man its modern fighting planes. Tonight he was trying his hand at guiding his ship safely through the darkness.

Two thousand feet below, the giant landing field was the size of a pocket handkerchief. The borders were outlined in green markers and red obstruction lights, while in the center of the field a faint patch of light showed the area swept by the landing floodlights.

The roar of the motor was sweet and even, the BT-9 responding to the controls with a smooth precision. Compared with the light PT-13 of his early training, it seemed like driving a fast racing car instead of a truck. At times he was almost frightened at so much power under his throttle, but now he was getting the feel of the ship. Three

nights of dual flying with his instructor had given him confidence.


"He's giving me a free hand this time," he thought, missing the occasional reassuring pressure on the controls—then realized that only a sandbag ballasted the rear cockpit; that his instructor was down below in the glass-windowed control tower, with the dispatcher and other instructors whose cadets were soloing tonight. Down there, he knew, keen Army eyes were watching, weighing him, testing his value to the nation that was giving him its best here at the famous "West Point of the Air."

From time to time, in the distant sky, tiny red and green lights moved and disappeared. Seven other cadets were practicing, each in his own quarter of the sky—three with Jones below the 2,000-foot level, four safely above 2,500.

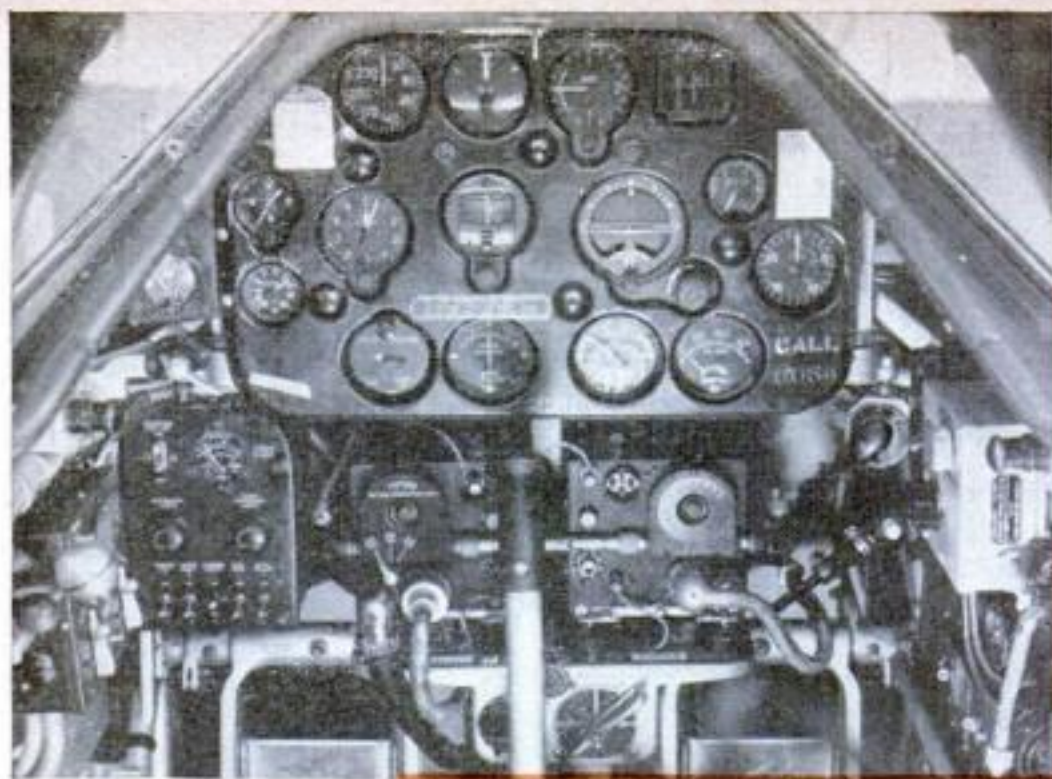
In his headset a hoarse voice rose above the static: "Lower Zone 2, come in for a landing." Atop one of the hangars flashed two parallel lines of red lights.

Rick flicked the radiophone to "Send" position and replied into his microphone: "Lower Zone 2 to Tower. Received O.K." Heading back in a descending spiral

By **STERLING GLEASON**

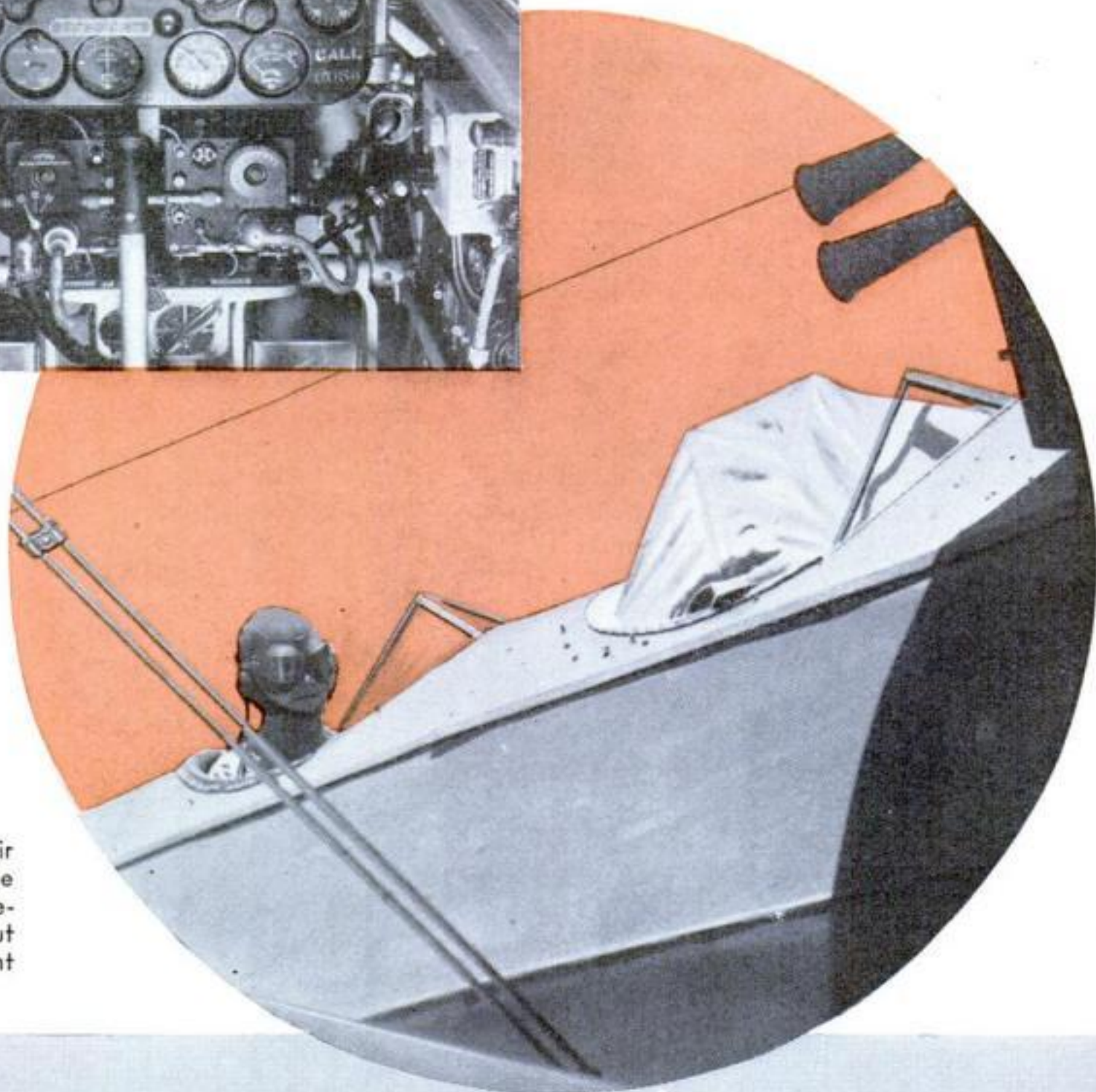


Cadets being shown
the fine points of
one of the giant
B-18 Army bombers



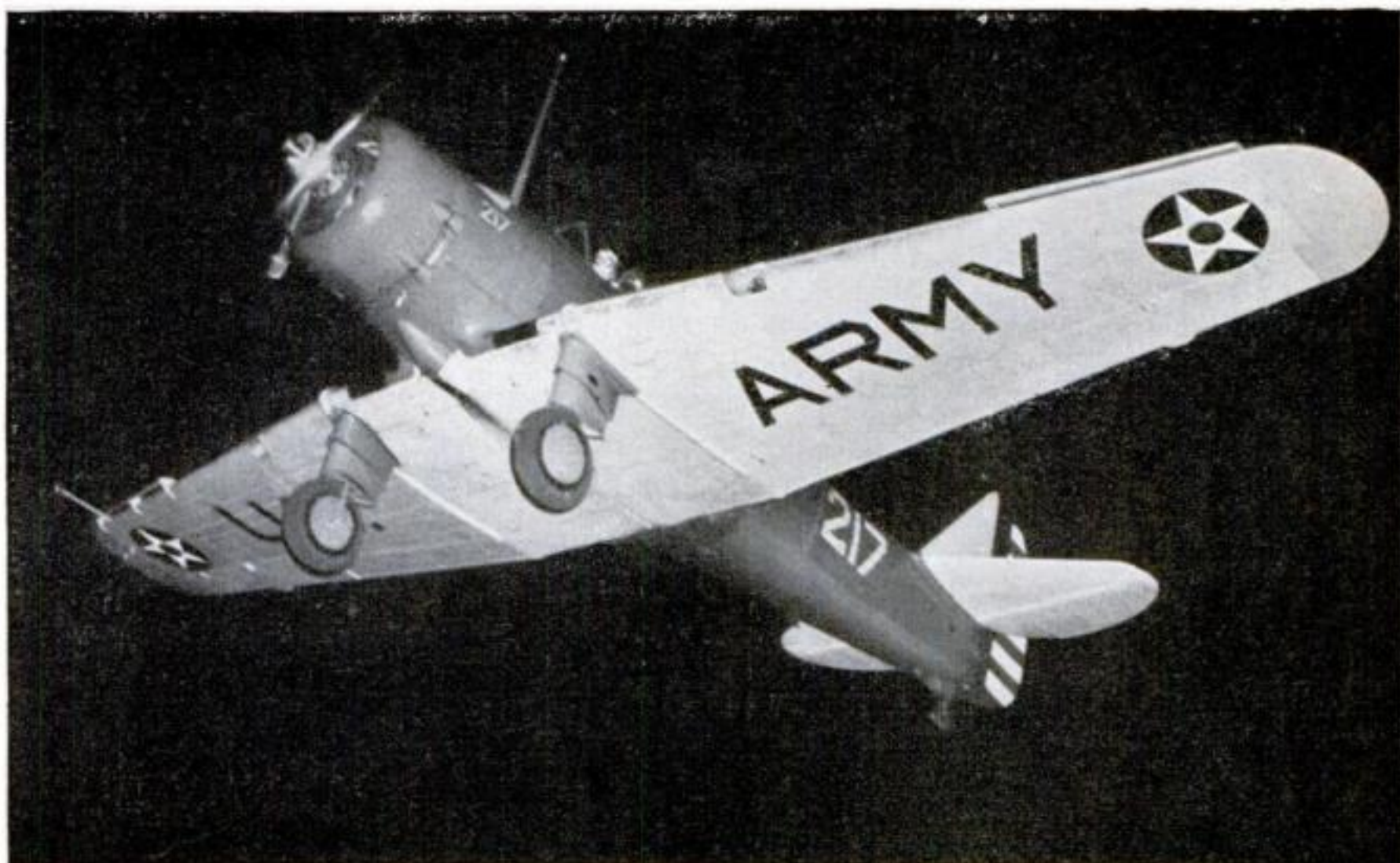
Under the hood on the plane below, a student is learning to fly blind

What a cadet sees in the cockpit of the BT-9 trainer used at Randolph Field



Harnessed up in their parachute packs, the fledgling pilots below are starting out for a morning flight





A BT-9 in the air at night, snapped from another plane. This type of plane is used for basic training

toward the field, he lost altitude; laid his course parallel to the base of the swiveled wind T outlined in green lights, and descended to 500 feet as he traversed the imaginary "base leg" of his entrance to the field. A square turn headed him straight into the wind. He cut his gun, lowered his "air-brake" wing flaps, and settled rapidly at the correct gliding angle.

Out of the dark rushed the plane, into the slanting glare of the floodlights' diagonal beams. The landing wheels bumped and he was taxiing rapidly over the field.

"Good landing. Now roll up your wing flaps and go back to your zone."

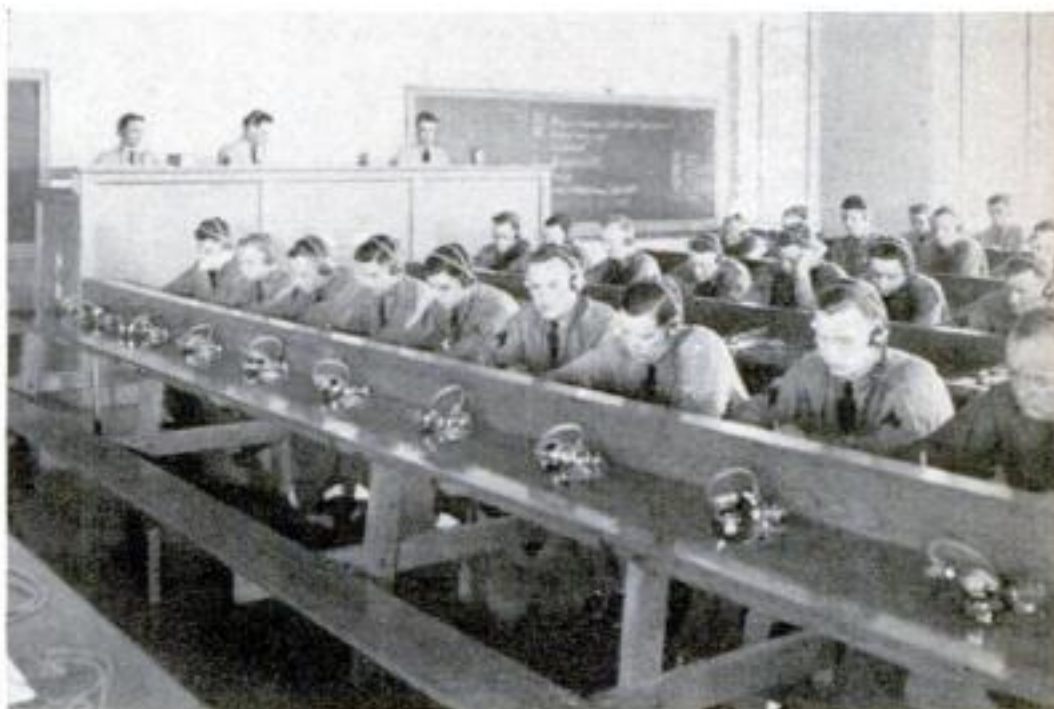
Rick cranked the handle of the flap controls, pushed hard on the throttle, and again raced into the blackness at seventy miles an hour. As the jolting stopped and the field dropped away from his wheels, three red bars flashed from the hangar top and the headset said, "Lower Zone 3, come in for a landing."

One after another, the eight cadets went through their paces in solving night problems, always under the watchful direction of the instructors who rode with them or watched from the control tower below.

Again Rick landed by the aid of a 300,000-candle-power parachute flare, hurrying to reach the ground before its unearthly brilliance failed. Then came the most

formidable problem of all—"wing-tip" landings, guided only by the beams from the lamps sunk into recesses in the leading edge of the monoplane's wing. To make the sudden drop down into nothingness, down toward a hypothetical landing field that was merely a square black hole, was like jumping blindfold from a high springboard. The red line of marker lights rose and fell on the horizon as he dipped and raised the nose of the plane. Then a gray patch as the beams began to reveal the surface of the field. A split second's anxious suspense, a lightning judgment of distance—then the bump of the wheels, a sweep across the field, and off to try it again.

The next day, a new problem was presented



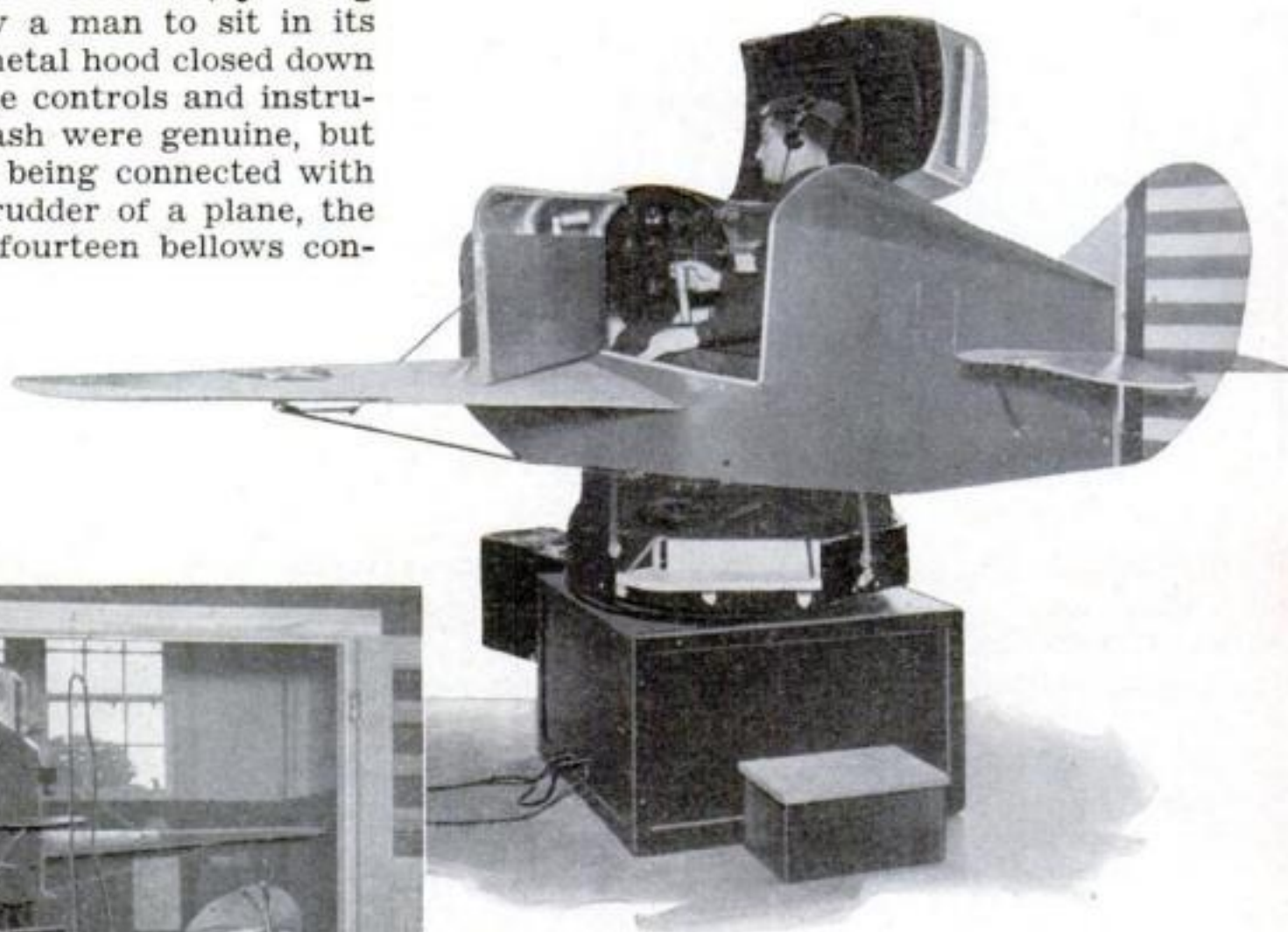
Buzzer practice gives skill in receiving messages sent in code

as four G Flight cadets gathered about a table in the hangar annex, looking over the shoulder of the man at the microphone. Across the wide chart upon the table crept the "bug," an instrument vaguely resembling the workings of a phonograph. Upon its three casters it sidled about like an ancient, cautious crab, leaving a narrow ink track in its wake.

From the bug a small cable trailed across the room to a fat, stubby airplane known as the Link Trainer, just big enough to allow a man to sit in its cockpit with a metal hood closed down over its top. The controls and instruments on the dash were genuine, but instead of their being connected with the motor and rudder of a plane, the "jeep" rode on fourteen bellows con-

cealed in its base. When the pilot of this unique craft pulled the stick back, the nose began to lift and the altimeter needle kept pace with its upward "flight."

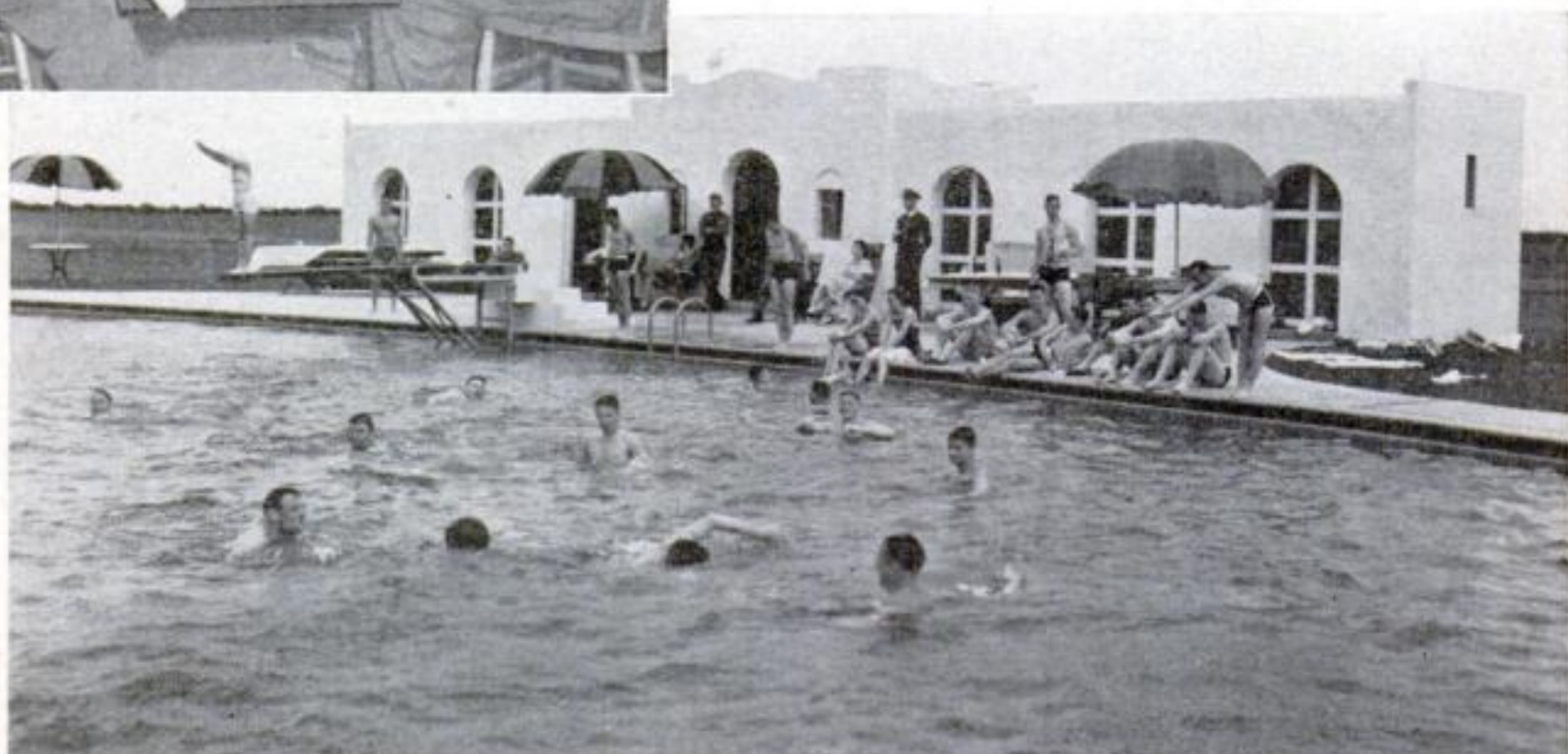
For all practical purposes, the jeep was a real airplane. In it every cadet must get his initiation into blind flying; every Army pilot, regardless of rating, must spend a given number of hours in it each year to keep in practice. *(Continued on page 239)*



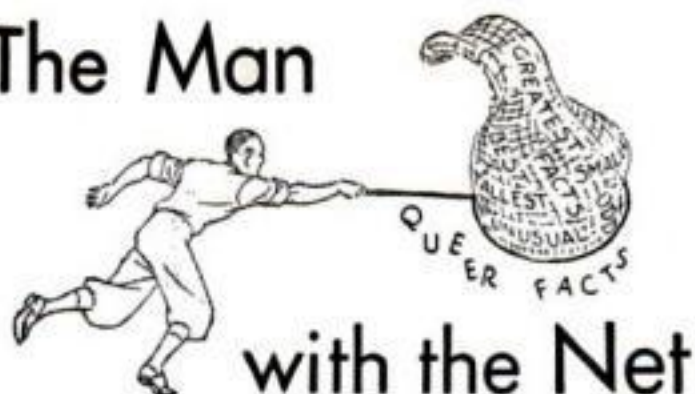
This is the "jeep," or Link Trainer used in teaching blind flight. As a student maneuvers the dummy plane, his flight is traced on a map by the "bug," the queer mechanism seen on the table at the left



Life at Randolph Field isn't all work, as proved by this view of one of the pools



The Man



with the Net

DEPOSITORS in New York State savings banks have an average nest egg of \$915.

UNDER one street corner in New York City there are 560,000 telephone wires.

ALABASTER is a kind of gypsum.

KANGAROOS can scent a man at a distance of four miles.



THE B.O. ADS ARE MISSING A BET!

AVERAGE three-week-old babies can hang by their hands longer than average thirty-year-old parents.

ROME had a larger population in the first century A.D. than it has today.

NEPTUNE, the planet, has not completed one circuit of its orbit since it was discovered in 1846.

EIGHTEEN HUNDRED brands of automobiles have been put on the American market in the past forty years.

BIRDS in Poland migrated south early, last fall, when German armies invaded the country.



RADIUM has been discovered in some of the dyes used in ancient Navaho blankets.

MAN-OF-WAR BIRDS have a seven-foot wing spread; yet their dried skeletons weigh only one quarter of a pound.

SWITZERLAND has an average of sixteen natural springs for every square mile of land within its boundaries.

IF DEY VAS DER RIGHT KIND I WOULDN'T CARE HOW FAR I FALL!



Gasproof Canary Carrier

CANARY birds kept as pets by one Englishwoman would be protected from gas attacks by means of a novel pushcart while she sought safety in a gasproof chamber. Air from a pump operated by one wheel of the cart enters the glass cage through a gas filter as the wheel turns. If the cart is stationary, the wheel may be turned by hand.

Storage Flash-Light Cell

TINY portable storage cells are now available for use in flash lights. Readily recharged, the cells require little care and are said to be very economical. They are the size of dry cells.



This cell works just like a car's storage battery

Handy Aids for

Meter Tests Light for Color Film

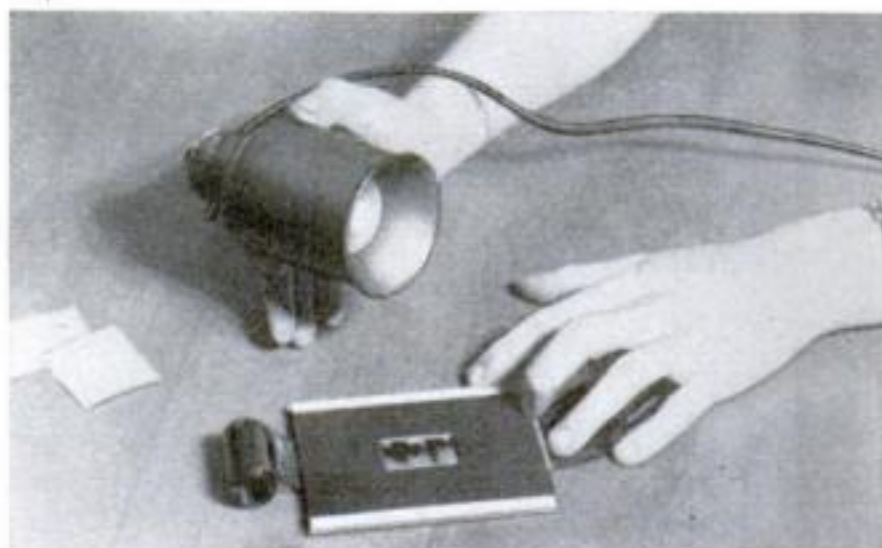
PRESET by means of auxiliary filters and a special test candle that burns at a known "color temperature" to allow for any error in the color sensitivity of the user's eyes, a new meter shows the photographer whether the artificial light for color pictures is correct for the color film he is using. Since each type of color film is sensitive to a specific color range in the spectrum and every light bulb burns at a given color temperature with a given voltage, the device permits matching the light source to the film sensitivity, by sighting through it while a dial is turned.

The dial shows if the light is right for color pictures



New Contact Printer for Small-Size Negatives

DESIGNED especially for making contact prints from miniature negatives, a new printing frame comes supplied with a 7½-watt lamp in a housing that fits snugly over the frame for making the exposure. Inserting the negatives and the film in the frame is accomplished easily, and a convenient switch operates the light. The outfit is compact and inexpensive.



Walking Stick Becomes Camera Tripod



With the handle and tip removed, the cane shown at right becomes a camera tripod



SERVING either as a cane for the strolling photographer, or as a tripod for the picture-making stroller, the combination accessory shown in the photographs at the left has just been introduced. Made of telescoping steel sections hinged at the top, the three legs form a sturdy camera support when spread apart and extended. Collapsed and folded together, they form the shaft of a walking stick when the curved handle and a special tip are replaced.

Camera Enthusiasts

Handy New Copying Stand

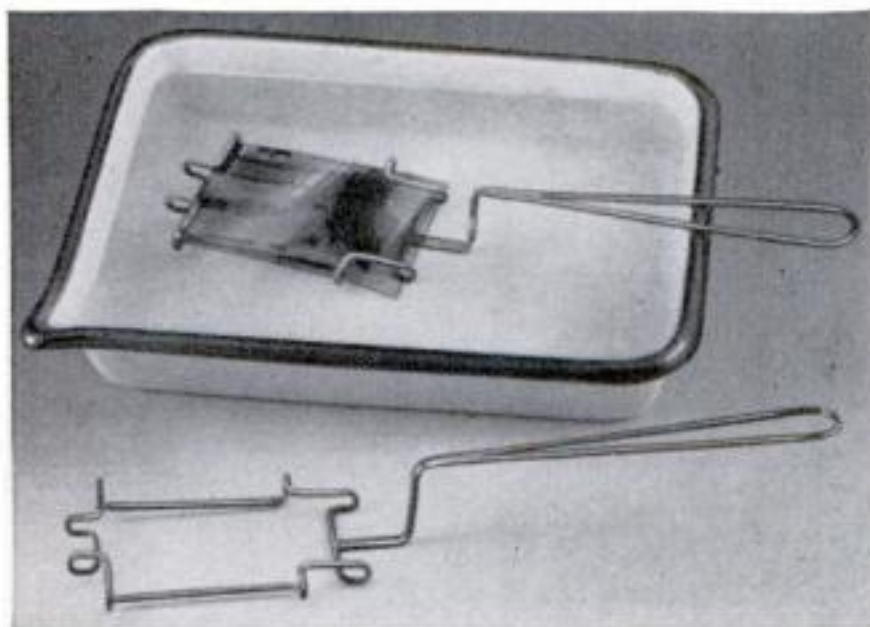
EQUIPPED with a set of extension tubes and lenses and a ground-glass for focusing, the miniature-camera copying stand at the right makes it easy to photograph small objects or flat work at close range. A wooden baseboard supports a vertical tube which holds the camera by an adjustable arm.

Movie-Editing Desk Set

Like a pen-and-pencil desk set, a new aid for amateur-movie editors holds an emulsion remover and an adhesive applicator. In use one instrument releases water, the other adhesive, a drop at a time.



This set keeps two splicing tools always at hand



Rack Holds Single Film

FOR developing single pieces of cut film or film from a pack when it is not desired to use a tank, the stainless-steel-wire holder shown above holds the film safely by the edges and prevents contact of any part of the film with the tray. It is available for several sizes of films.



A micrometer screw is used to get a sharp focus

File for Transparencies

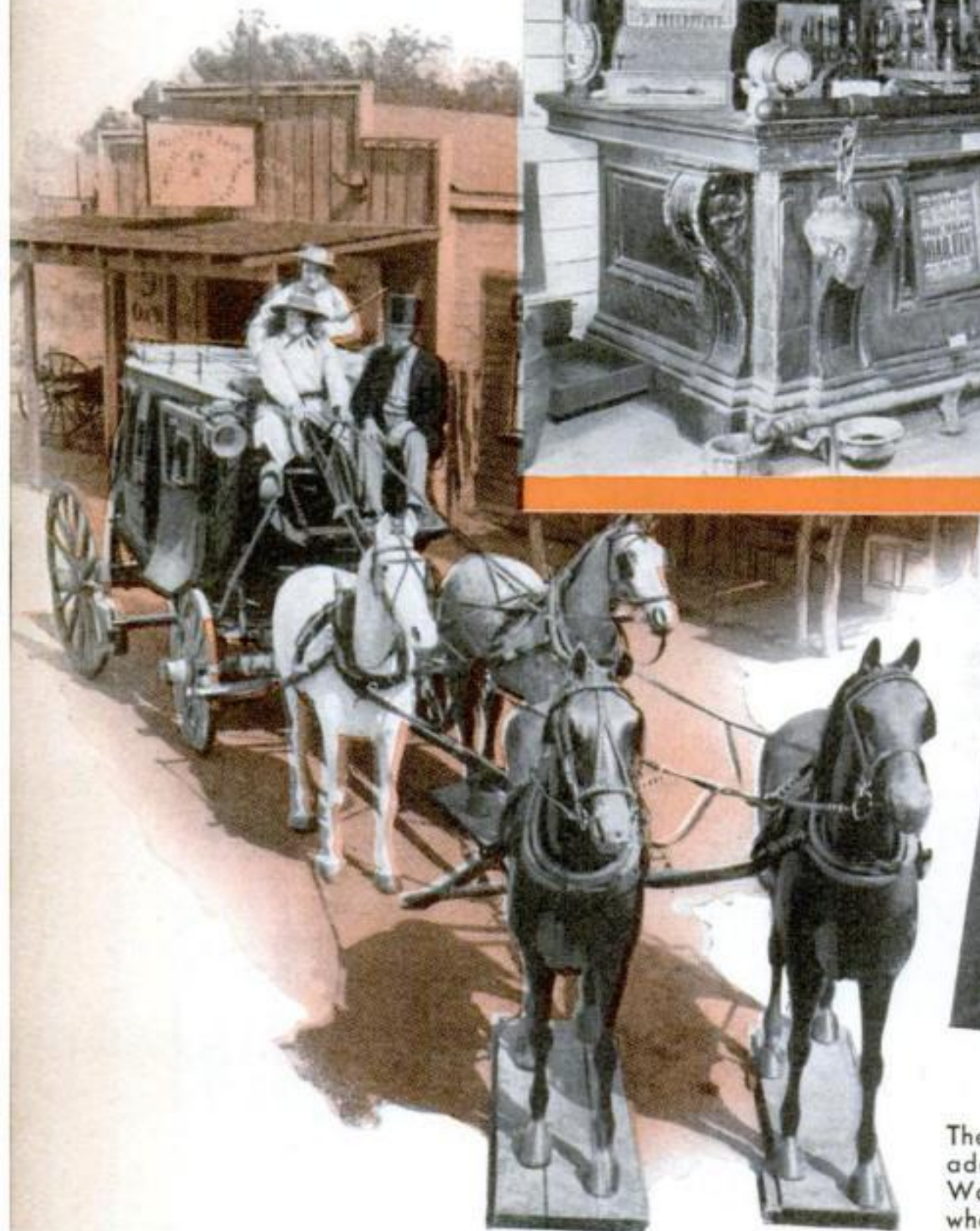
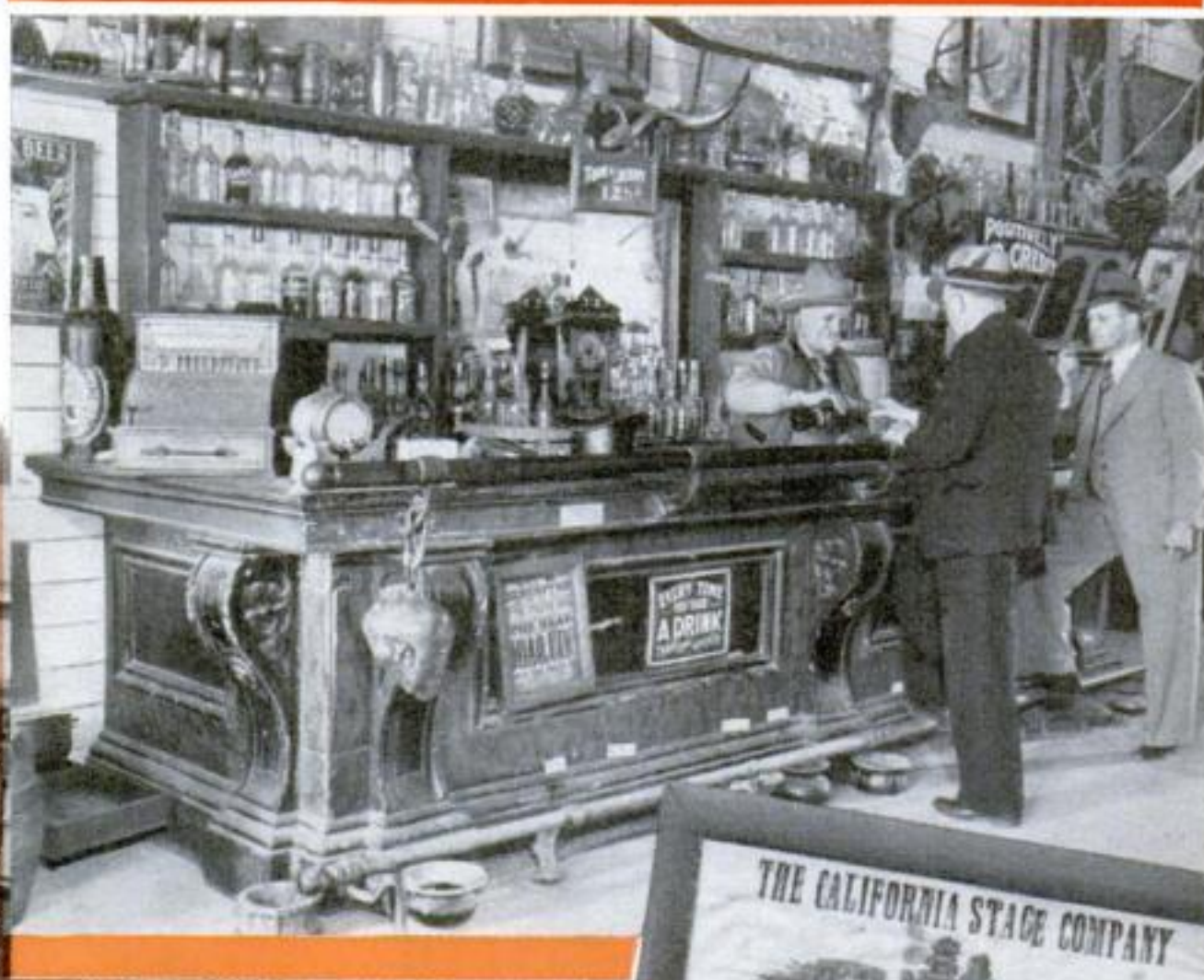
LAMINATED cardboard pages that fit into loose-leaf binders for storing two-by-two-inch mounted transparencies offer a novel filing system for your miniature films. Each panel holds twelve transparencies firmly sandwiched between heavy paper-board frames open both front and back for quick viewing and selection for projecting.



Transparencies filed in the book are easy to view

Ghosts of the Wild

By
Andrew R.
Boone



The bullet-riddled bar above was an early addition to W. Parker Lyon's museum. Wooden horses are hitched to the coach whose trips the poster once advertised

HANK MONK shoved his old Concord stagecoach from Hangtown, Calif., across the mountains to Virginia City, Nev., and Bill Cody lashed his horses between Leavenworth, Kans., and North Platte, Nebr., little thinking that future generations would gaze with admiration upon their bullet-riddled, six-horse mud wagons. Pony-express riders, galloping at

top speed across prairies and mountains, helped build civilization in the West with an eye to the future, yet seldom sought personal fame.

But one man, inspired by the West's dramatic history, started a quarter century ago collecting every item he could find of the pony-express and gold-rush periods. Each year he adds newly discovered "originals"

West

COLLECTOR RE-CREATES FRONTIER DAYS IN ODD MUSEUM

as he pokes about the ghost towns of Nevada and California and scours the communities, both thriving and abandoned, where once the stage lines ran. At his Pony Express Museum, in Arcadia, Calif., W. Parker Lyon displays nearly 1,000,000 items, from pony-express saddles to tomahawks, wooden Indians and wooden horses to a petrified forest.

Lyon has poured more than \$500,000 into his novel museum. Five stagecoaches represent the vehicular phase of western passenger transportation. Freight wagons and fire engines from ghost towns, the thriving mining camps of yesteryear, tell of building booms and efforts to save property from flames. Many interesting relics give us a picture of the hard life men knew in the early days of the West. Gambling paraphernalia, square nails, patent medicines, paper and celluloid collars, high laced shoes of the 1860 flappers. From Hangtown, Bed Bug, Rabbit Creek, Murderer's Bar, Onion Valley, Rattlesnake Bar, and Rough and Ready. You don't know them today. Hangtown became Placerville, Bed Bug is Ione,



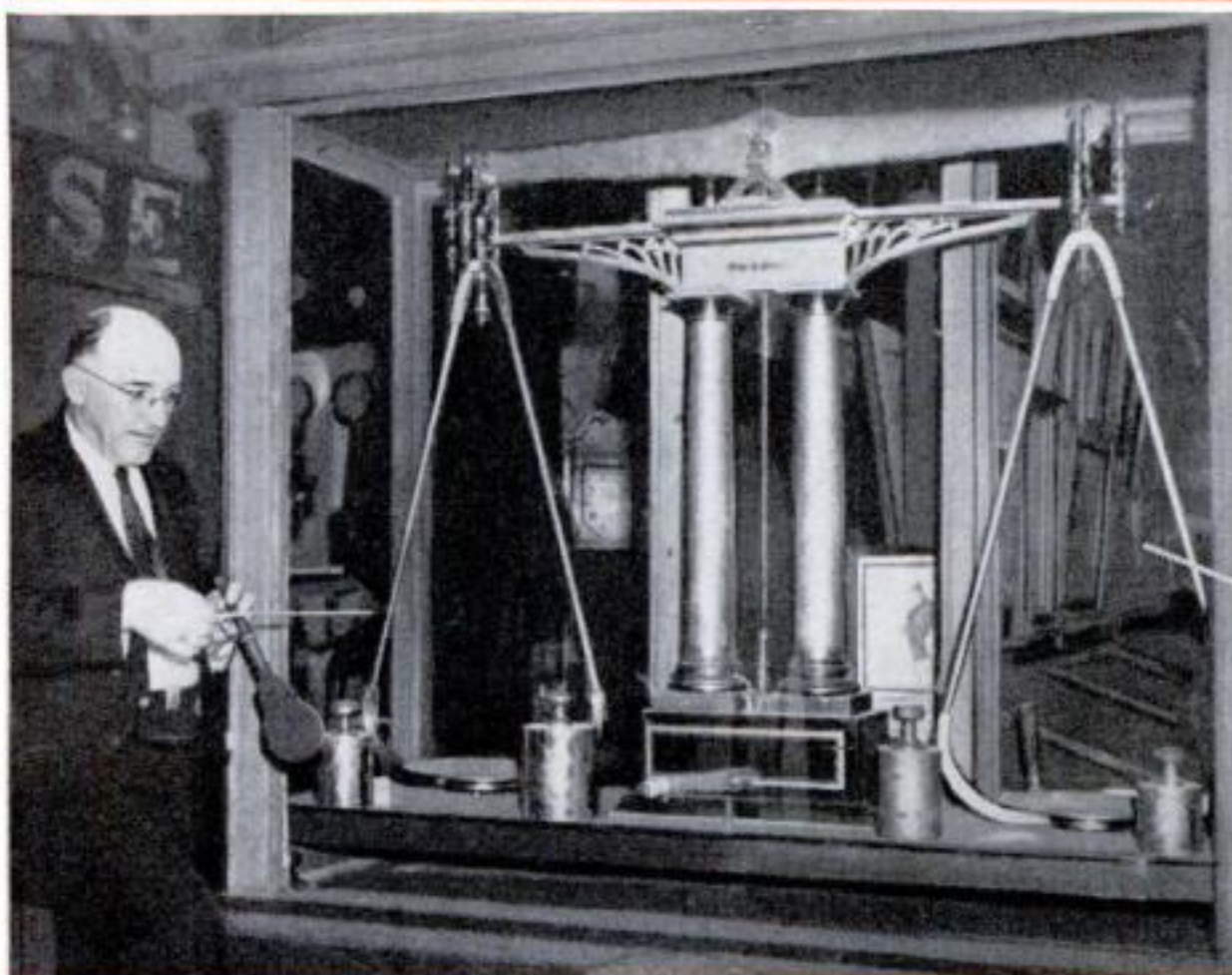
Entrance to the Pony Express Museum. It is a copy of the station and general store at Sonoma, Calif., as it looked in 1850

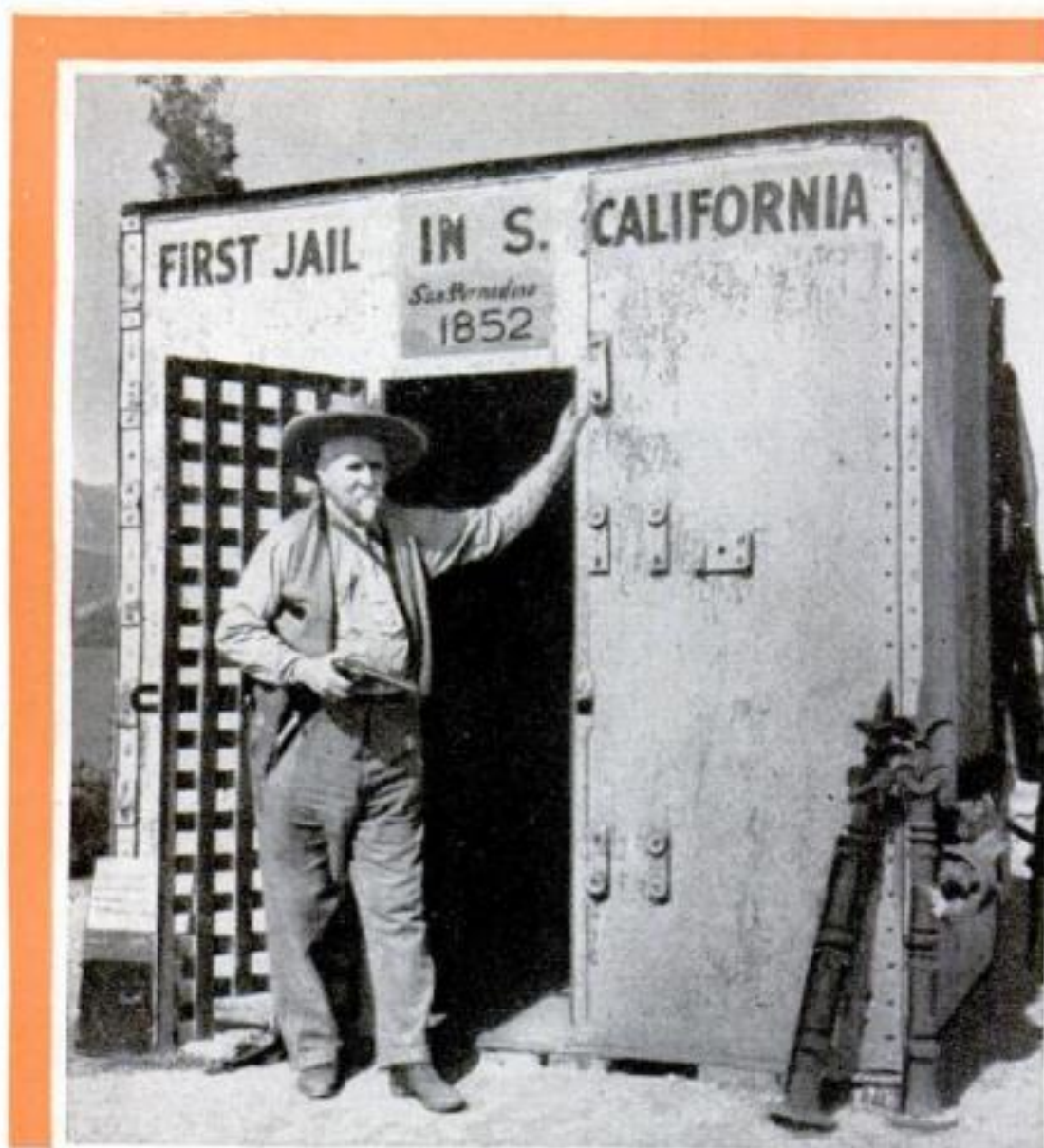
Rabbit Creek transformed into La Porte.

A simple incident led Lyon to establish the museum. An active stamp collector some twenty-five years ago, he drove his huge old automobile from Pasadena 500 miles north seeking an old stamp. He had heard while on a visit in Europe that the "western franks" were valuable items.

These were not stamps in the accepted sense, but were imprinted directly on the envelope much as a cashier

Extremes in gold scales are the one at left that handles up to 1,000 ounces, and the portable banjo scales below





Southern California's first jail. It housed desperadoes at San Bernardino in 1852. The cigar-store Indian once gazed upon the main street of Hangtown, renamed Placerville, Calif.



receipts a bill. Many showed a pony galloping across country, with "Pony Express" printed above it.

Finally locating the Dobbins ranch, up in



Lyon panned \$22 in gold sucked into the machinery of this fire engine found in an empty ghost town

the mountains of Yuba County, where he understood a rare express stamp could be bought for \$65, Lyon found not a stamp but the stagecoach which Hank Monk once drove between Hangtown and Virginia City. "I kept thinking of all the famous characters of western history who might have ridden in that coach," Lyon often relates, "and the more I thought about it, the more that hard-riding buggy appealed to me. Well, I bought the coach instead of the stamp, hooked it onto my car and drove home."

That was the first item of his museum. The second, acquired not long afterward, was a fifteen-foot bar which had been brought around Cape Horn to California in 1849, and served a checkered career in the vicinity of Mariposa. Five bullet holes, said to have been shot through it by a sheriff attempting to capture a man, give it added interest. Over it hangs this placard:

"This bullet-scarred bar is historical. Gen. Fremont, U. S. Grant, Mark Twain, Bret Harte and Joaquin Miller drank gallons of red liquor over its polished top in the early fifties."

Anything belonging to the old West will find a place in this collection provided Lyon

can find it. He seeks only originals, and travels thousands of miles yearly in his station wagon, which often returns to the museum heaped high with everything from stoves to bath tubs.

Some surprising objects turn up as Lyon pokes around towns and pursues rumors. At Dayton, Nev., recently he bought an eighty-four-year-old fire engine. Some days later, when chipping away pieces of black sand and gravel carbonized in the suction machinery, he came upon several gleaming yellow flecks resembling gold. Twenty-two dollars worth of the prized metal was panned out of the long-incrusted ore.

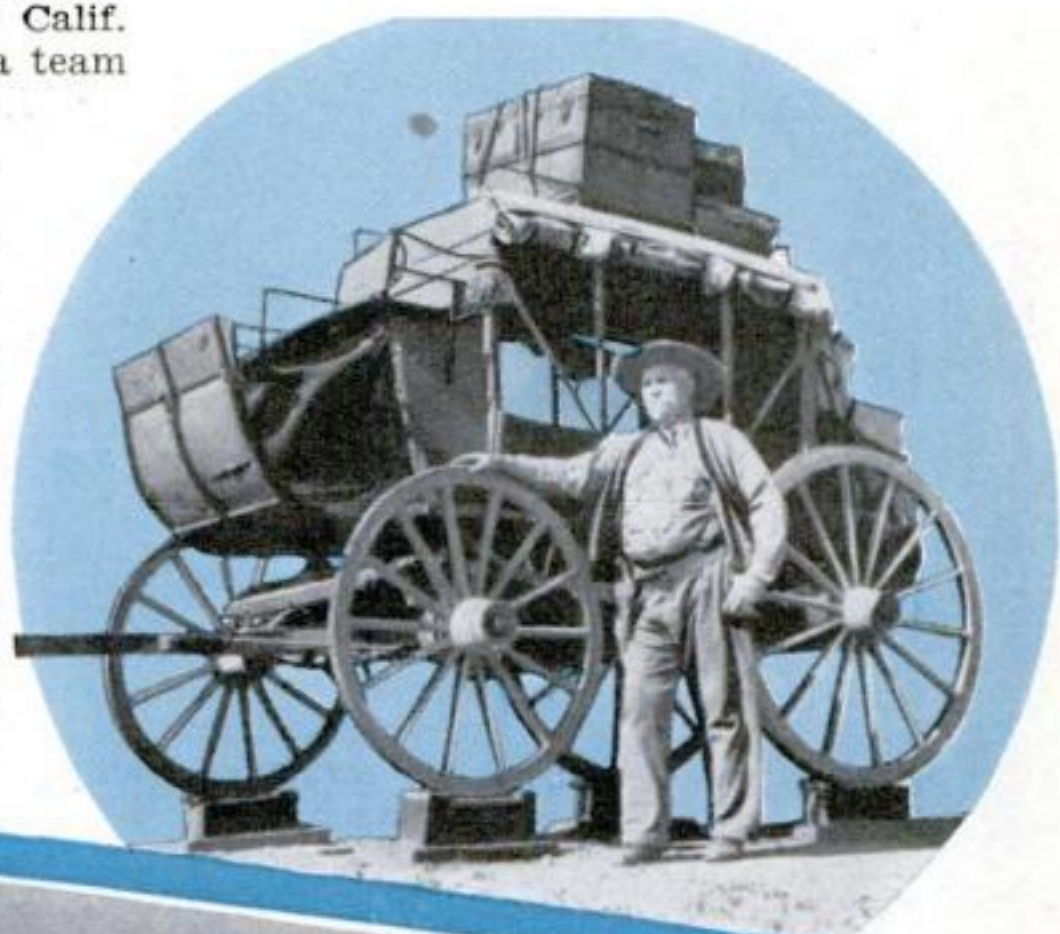
On another journey, he found a wooden horse in a livery stable at Truckee, Calif. This gave him the idea of hitching a team to one of the old stagecoaches, and before returning to Arcadia, he had rounded up nine of them.

Up in Calaveras County while seeking a wood stove, he found a twelve-foot muzzle-loading shotgun, used by some pioneer to shoot game across wide canyons. Far too heavy to be held against the shoulder, it was fired on a rest, its butt backed up against a tree.

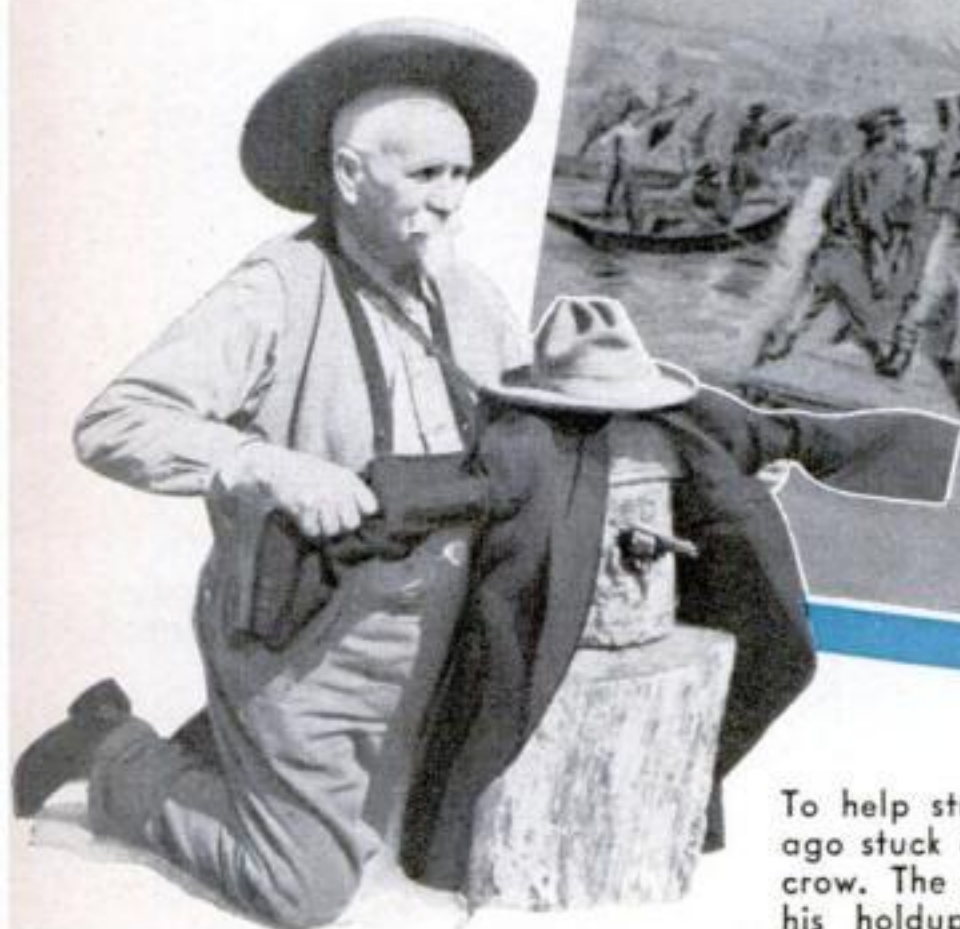
Sometimes the wandering collector finds more invaluable relics of the hard-riding, hard-drinking, hard-fighting pony-express days than he

can bring home in a single load. On one of his junkets he found the largest gold scales known in the west. The scales, made in 1858, were capable of weighing 1,000 ounces of gold or silver, and were so delicate a fly would unbalance the pointer.

Other strange relics include fifty safes, most of them former Wells Fargo depositories; a revolver fitted into a tree stump which, attired in a hat and coat, served as a dummy "accomplice" in almost forgotten stagecoach robberies; a small cemetery; a one-cell jail; a barber's chair bearing blood stains of a man shot dead in it; and a hotel menu listing a moderate dinner at \$5.75.



The historic stage-coach in the circle is ninety years old. It is one of five in the unusual museum



To help strike fear into his victims' hearts, a bandit sixty years ago stuck a gun in this tree trunk and dressed it up like a scarecrow. The gun was fired by a string as the bandit conducted his holdup. Above, an old print that hangs in the museum

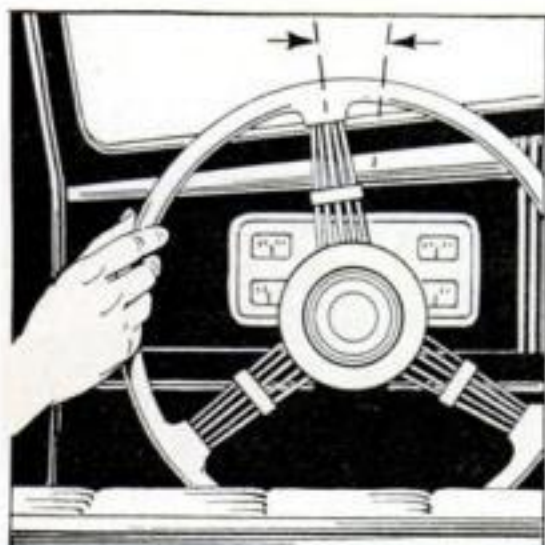


Jack Fletcher explains a special gauge to a client for whom he is testing a used car **BEFORE** she buys

How Good

You Can Find Out for Yourself Using the Simple Methods That Set Jack Fletcher Up in His Own Remarkable Business of Advising Automobile Buyers

By
JOHN EDWIN HOGG



With the finger tips, turn the steering wheel back and forth. Play should be only two and a half inches



Side play or clatter here promises trouble or bills

STEERING GEAR: See that all four tires are evenly inflated. Point the front wheels straight ahead. Now rock the steering wheel back and forth, holding it with the thumb and finger tips. Free movement of

the wheel in excess of two and a half inches before the front wheels begin to move is a sign of worn mechanism or a steering assembly too loose for safety. Repairs here are expensive.

FRONT-WHEEL ASSEMBLY: With wheels pointed straight ahead, stand beside a front wheel, grasp the top of the tire firmly and shake the wheel with a pushing and pulling motion. A slack feeling or a clatter indicates wheel bearings, king-pins, or both are loose. Loose front-wheel assemblies cause faulty steering, shimmy, and abnormal tire wear. Proper repairs will cost from \$7 to \$22.

MOTOR: Check the oil while the motor is at air temperature. Oil on the gauge blade should not be heavier than SAE 30 or 40. If you find heavier oil, demand that it be changed to a lighter grade before your demonstration drive. If the oil is O. K., examine a "clean motor" for oil, water, and compression leaks after running the motor until it is heated to normal driving temperature. When the motor is running hot, speed it with short, heavy thrusts on the foot throttle and watch for bluish-white smoke from the exhaust. If the motor smokes, oil is leaking past the piston rings. This means faulty piston rings, worn pistons, and, perhaps, cylinders in need of reboring. Remember that motor overhauling is about the most expensive form of automobile repairing.

STARTING MOTOR: With the ignition off, step on the starter for about ten seconds. Repeat this three or four times. Broken, burred, or badly worn teeth in the flywheel starter gear will clash and grind or keep the gears from engaging. Proper repairs cost from \$3.50 to \$30.

Is a Used Car?

IN 1933, Jack Fletcher, a Los Angeles, Calif., automobile mechanic, was earning little or no money at his trade. Today, he is the proprietor of a thriving business that helps his customers get their money's worth when they buy a used car.

How did it happen? The idea came to him after he learned that more than half the cars on the road were bought second-hand. He'd been a mechanic long enough to know that few motorists knew very much about their cars beyond what they saw on the surface. He also knew that plenty of those second-hand-car buyers had been stuck.

"I've got it," he told his wife. "In thirty days I'll be working eight hours a day."

It was probably longer than thirty days before his prediction came true, but he stuck

at his idea, and today it's true and then some! For daily to Fletcher's office come used-car buyers. His job is to examine inside and out the cars they buy—before they buy them. It takes two hours, and his fee is \$10.

Fletcher's files contain long lists of car models and records. Pick any car produced since 1920, and he'll tell you what its life expectancy is. His clients usually select the car they'd like to buy—following his suggestions on how to judge them—and then he goes into action.

Are you planning to buy a used car? Then it will pay you to make use of Fletcher's easy tests given on these pages. They will help you to separate the "good buys" from the "lemons," and you don't have to be a skilled automobile mechanic to use them.

CLUTCH: Standing outside the car, depress the clutch pedal with the finger tips. You should find about half an inch of practically free motion. If there is no free motion, the clutch may have been burned by slipping or so badly worn as to need relining. Correct free movement of the clutch pedal, however, does not necessarily indicate a clutch in good working order; the pedal may have been reset. A reliable clutch inspection can be made only by auto mechanics. Lasting clutch repairs cost from \$6 to \$28.

BRAKES: Sit behind the steering wheel and press the brake pedal down firmly. If the pedal goes to the floor, the brakes are not properly adjusted and may need relining. To test hydraulic brakes, press the brake pedal down and hold it down firmly for at least thirty seconds. If the pedal slowly sinks, the hydraulic system is defective. Proper brake repairs may cost up to \$24. Remember, too, that any old brake lining or worn linings bushed with strips of asbestos will make very defective brakes hold temporarily. **YOUR LIFE AND THE LIVES OF OTHERS WILL BE ENDANGERED BY FAULTY BRAKES!**

TEST FOR MOTOR ADJUSTMENT: With the car in high gear, slow down to ten miles an hour (with slight pressure on the brakes, if necessary). Release the brakes and accelerate quickly to full throttle. If the car gains speed quickly and smoothly, without choking, sputtering, or bucking, you may be fairly sure carburetion, valves, valve guides, and ignition are functioning properly.

TEST FOR DRIVE ASSEMBLY: With the car in low gear, speed up, apply the brakes, and shift into reverse as quickly as possible. Repeat this several times. A worn clutch will slip or engage with a jerk. If warped or out of alignment it will shudder, squeal, or chatter. Excessive wear in transmission gears, universal joints, and differential will appear as slack or lost motion if the car does not respond smoothly to the change of motion forward and backward.



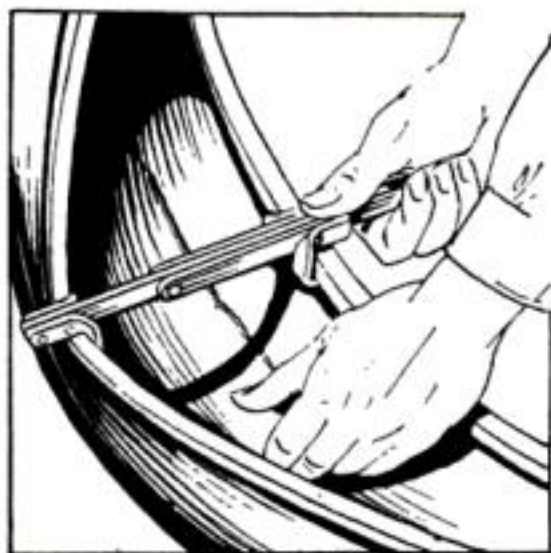
Heavy engine oil covers a multitude of sins—and of knocks. Be sure it's light enough before you listen



Initial clutch test. Press down pedal with fingers. A half inch of play is about the right amount



Get behind the moving car and make sure the wheels track. If they don't, don't buy that car!



The only way to tell if a tire is safe is to have an expert remove it and examine the inside



When the new models come out, used-car prices drop. So that's the cheapest time to buy one



If the car hasn't an all-metal top, test the fabric with your thumb. New tops are expensive

TRANSMISSION AND BEARINGS: With the car in low gear, speed up quickly to twenty or twenty-five miles an hour. Loose motor bearings will knock and a worn transmission will squeal or grind. If there is a hill near-by, coast down in high gear with the clutch engaged, brakes free, and the foot off the throttle. Under this test any abnormal motor noises are accentuated and a worn transmission clatters.

DRIVING TEST FOR STEERING GEAR: Avoiding cross winds, drive at about twenty-five miles an hour on a smooth, flat road. Take your hands off the steering wheel and watch the car's performance. It should go fully 100 yards without any tendency to drift off the road. Any pronounced drift in this distance indicates that the steering mechanism may be excessively worn or out of adjustment, wheels may be out of line, axles bent, springs sagging, or the frame of the car out of alignment from crash damage. Lasting repairs for correction of these troubles are expensive.

ANOTHER NOTE ON STEERING GEAR: Driving only as fast as you can safely make a right-angle turn, turn sharply to the left and right several times to see if steering gear binds at any point. Attempted adjustment to overcome excessive wear will create this dangerous condition. There is just one remedy: a costly steering-gear rebuilding.

REAR AXLES AND TRANSMISSION: Take out the seat cushions. On a smooth, quiet road, accelerate and slow down gently, and then let the car coast to a stop with the foot off the throttle and the gears in neutral. If, in making these tests, you hear any pronounced chatter, rumble, or grinding sound, you can be sure of facing an expensive overhaul. If the car has hypoid gears, reject it if these tests produce any suspicious noise at all.

FAULTY ENGINE BEARINGS: Drive at about fifteen to twenty miles an hour and apply the brakes while maintaining the speed by feeding more throttle. Don't stall the car with the brakes until the throttle is clear down. Disregard sharp, pinging carbon and spark knocks and listen for a muffled, hollow knocking in the motor. You should hear this knocking in all cylinders. If the knocks are not all very similar, it indicates one or more loose bearings. This is admittedly a drastic test, but if you hope to drive long distance at high speed, reject any car that cannot meet it.

ROAD TEST FOR BRAKES: No car is safe with brakes that will not check speed without chattering, squealing, grabbing, or causing the car to swerve from its forward course. Brakes are particularly important if you expect to drive on mountain roads or in any very hilly country. Brakes that are entirely satisfactory for city driving often fail completely when subjected to the heating of frequent braking on long grades. Inferior linings or "shimmed," worn linings will fail in any severe down-grade test. This test, however, should be discontinued with the first indication of brake weakness.

SPRING SHACKLES: If a car is stiff and jiggly when driven at about twenty miles an hour over slightly uneven pavement, look for worn spring shackles concealed by excessive tightening. On the other hand, if shackles are worn and loose, you'll hear them clatter if you drive the car over a stretch of "washboardy" or cobblestone road, or any piece of neglected pavement.

▣ **RESPONSIVE MANEUVERABILITY:** Road-test the car by driving at about forty miles an hour upon fairly rough road. If it has a tendency to plunge, swerve, or shimmy, or if the front wheels "tramp," or bounce rapidly, your safest course is immediate rejection.

▣ **GENERAL PERFORMANCE:** Sluggish pick-up on a level road or slight grade, together with a sharp pinging in the motor may indicate one or more defects—a motor heavily loaded with carbon, faulty ignition, faulty valves, or improper carburetor adjustment. If a dealer submits a car for testing in which such defects are present, you may be sure they are deep-seated and cannot be remedied cheaply.

▣ **ADDITIONAL NOTE ON PERFORMANCE:** Have someone drive the car at about thirty-five miles an hour along a smooth, straight road while you watch from the side. Watch for wobbling wheels and listen for unnatural sounds such as muffler and exhaust-manifold leaks, rattling transmissions, and body squeaks. Watch the wheels from behind to see how they track. Wobbly wheels indicate bent axles, damaged wheels, or faulty spindles—any of which will cause excessive tire wear. If rear wheels fail to track behind the front wheels, reject the car. It's not worth buying.

▣ **ROAD-TEST OBSERVATIONS:** Having found a car that appears to be a good buy, ask the dealer to let you drive it at least fifty miles. This is the only way you can check oil and gasoline consumption. A drive of this or greater distance over as wide a variety of roads as possible will also usually bring to light possible defects that are not readily apparent. And if the dealer is honest and has nothing to conceal, he should be glad to help put across a sale by giving a serious prospective buyer every opportunity to buy with his eyes open. You'll probably find him more than willing.

▣ **TIRES, TOPS, WHEN TO BUY:** Tires retreaded over defective carcasses are dangerous. Have a disinterested tire man inspect the tires anyway. If the car top is not the all-metal type, inspect it closely. A good top job costs from \$20 to \$50. As to car appearance, \$25 will get you a fine paint job, but a spray gun and \$3 worth of paint will not—for very long. A good time to buy a used car is in the fall after new models are announced and used car values decline.



Always road-test an automobile at forty on a rough road. It should neither swerve, wander, tramp, nor show signs of shimmy



Fletcher never neglects an under-car inspection. Any sign of a straightened chassis indicates the car has been in a crash

HIS ROOF IS A ROCK



Frank Critzer's desert home and airport. Note the wind sock on the painted boulder

AN AIR-CONDITIONED stone palace, complete with private airport, is the home of a California prospector who built it all with his own hands, at no cost save his own labor and a little dynamite.

Jobless, in 1931 Frank Critzer came to the desert 100 miles southeast of Los Angeles on a prospecting trip. While staking out gold and silver claims, he camped under the lee of a tremendous boulder, tall as a seven-story building, and later conceived the idea of burrowing beneath it. With pick and dynamite he worked until he had dug out an apartment measuring twenty-four by thirty-six feet, divided into two rooms and entered by a long staircase. Necessary lumber he salvaged wherever he could pick it up, hauling it many miles across the sands. His enthusiasm grew as the work progressed, leading to improvements that now include a well-equipped workshop with anvil and forge, and a picnic ground with toilets and lunch tables among the huge rocks studding the hillside above his burrow.

Downstairs, in a corner beneath the windows, is a large stove, fueled by desert kindling he gathers in an annual excursion



The prospector welcomes visitors to his strange house

to near-by Wood Canyon. Curtained off by a heavy rug is the bedroom, where Critzer keeps his rifles and shotgun, his wardrobe, and his library. At the head of his bed is a hole communicating with a tunnel running through under the rock to the opposite side. This forms his air-conditioning system. By removing an old coat from the porthole, Critzer gets good air circulation across the rooms, up and out the windows on the far side. Though the outside temperature reaches 110 in summer and fourteen in winter, the thermometer in his living room never goes above seventy-eight



Critzer at work in a tunnel under the rock. The hole lets air circulate through the living quarters



nor below sixty-four the year round.

Lonesome, Critzer often watched airplanes pass overhead and wished he could lure them to a landing. He whitewashed a huge boulder and topped it with a wind sock. With a crude drag of timbers and railroad iron chained behind his 1922 car, he ripped out the scanty growth, clearing an area 2,500 feet wide and more than a mile long. It took eighteen gallons of gas to level the field to its present velvet smoothness, well cushioned by hard-packed alkali sand. Nearly any Sunday, several airplanes visit the lonely outpost, most of them bringing picnic parties who use the accommodations Critzer has provided for them.

The lone prospector still is enlarging his quarters under the rock, expecting eventually to double his present room space. Most of it will be pick-and-shovel work, but occasionally he has to blast. For this, he simply removes furniture, drills a blast hole, sets the charge and covers it with timber, and touches it off.

Natural air conditioning maintains a comfortable temperature at all times



The lone prospector cleans a lamp chimney in his "living room," scooped out beneath a giant boulder

New Appliances



TOOTHBRUSH SAFE. Air entering this novel holder is filtered to remove germs. Turning the knob, as shown at right, brings the desired brush to the sliding door



FERRIS-WHEEL SHOE RACK. Eight pairs of shoe trees are mounted on a wheel in the convenient rack illustrated above. To select a pair of shoes, a user merely turns the wheel



SLICING PLATE. A wooden board set in a porcelain plate aids in serving sausage. Note the special knife and tongs for bologna

KNEELING STAND. Tasks that require kneeling are easier with the stand at the right. There is a rubber pad for the knees



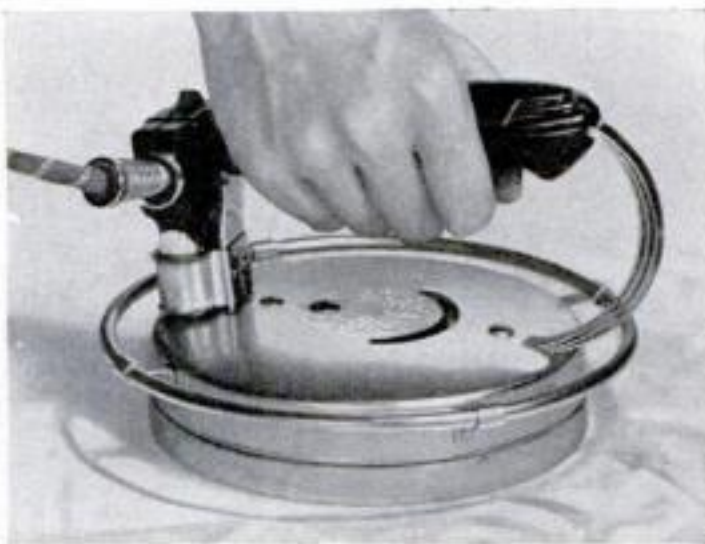
for the Household

MIXING SPEED for the machine at the right is regulated by turning a dial on which various foods are indicated by name

VASE BRUSH. Cleaning long-necked vases and bottles is easy with the brush below. Its sponge-rubber cleaning surface covers a flexible metal tip



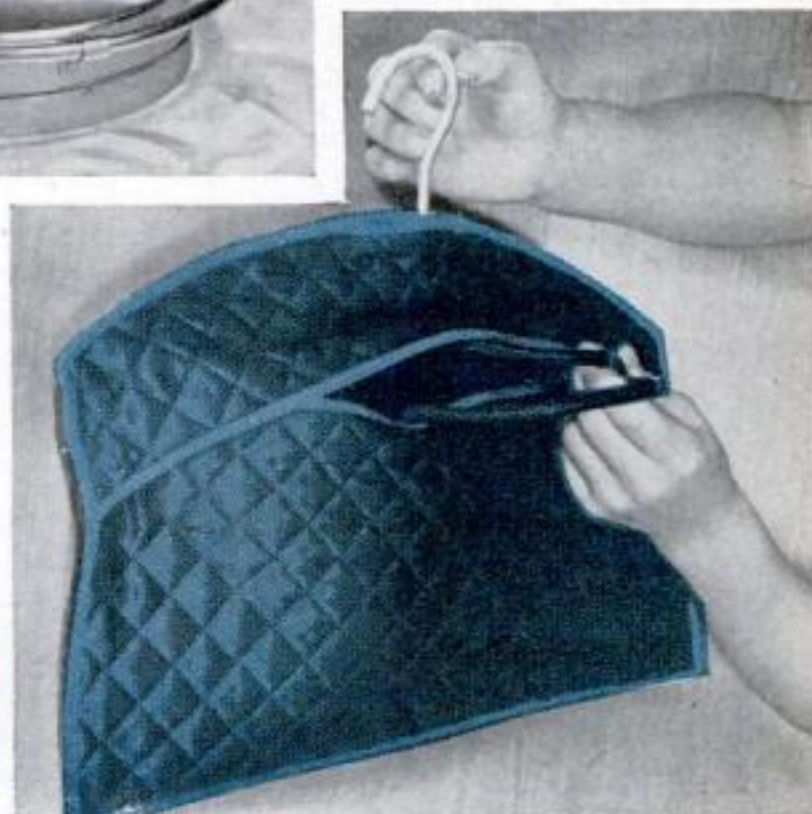
ROUND FLATIRON. Circular in shape, the plate of the new electric iron at the right covers a large area and speeds flat work



HANGER BAG. To keep a guest from forgetting hand-bag or gloves, the quilted silk bag below fits over a coat hanger. Small articles are placed in it when the visitor's coat is hung up



DOUBLE-BARRELED TEAPOT. Tea comes from one of the spouts of this teapot, hot water from the other. Marks on handle show which is which



POPULAR SCIENCE

Question Bee

If you can give the correct replies to sixteen of the brain teasers below, you've started out the New Year with a bang! To check up on your knowledge, turn to the answers on page 244



- 1 International law originally extended a country's sovereignty just three miles to sea, because (a) it was the greatest distance at which a vessel's flag could be recognized (b) a strong man could swim that far out and back (c) cannon of that time could shoot no farther.
- 2 The hardest material in the human body is found in the (a) thigh bones (b) teeth (c) finger nails (d) brain.
- 3 A sugar solution will not conduct electricity because it lacks (a) vitamins (b) ions (c) genes (d) hormones.
- 4 The sycamore is also known as the (a) whippletree (b) rooftree (c) family tree (d) plane tree (e) Christmas tree.
- 5 Euclid was the father of present-day (a) architecture (b) medicine (c) radio (d) geometry (e) paper hanging.
- 6 A weir is (a) a dam (b) an oven for pottery (c) the structure at the top of a mine shaft (d) a machine for making coil springs.
- 7 Taxonomists (a) manufacture taxicabs (b) stuff the trophies that hunters bring back (c) classify different kinds of plants and animals according to their relationship (d) study how to levy taxes on a fair and scientific basis.
- 8 The crankcase of an automobile is the place where you should put (a) the crank (b) gasoline (c) emery dust (d) motor oil.
- 9 Microscope specimens often are stained in order to (a) make them look pretty (b) bring out details of their structure (c) kill any parasites that might destroy them.
- 10 Electric cords contain two wires because (a) if one wire breaks, the other will maintain uninterrupted service (b) electric current comes in through one wire and goes out through the other (c) cords with twin wires lie flatter under rugs.
- 11 Tinctures are solutions in which the solvent is (a) oil (b) water (c) alcohol (d) acid.
- 12 Uranium is (a) one of the moons of the planet Uranus (b) a radioactive element (c) the best food for tropical fish (d) an important ingredient of concrete.
- 13 Taste buds are found in (a) florists' shops (b) artichokes (c) the human tongue (d) insect-eating plants.
- 14 An invertebrate is (a) a stunt pilot (b) the mirror image of a geometrical figure (c) an animal without a backbone (d) a person who shows no gratitude for a kindness.
- 15 When fish lay eggs, they are said to be (a) calving (b) molting (c) spawning (d) pollinating.
- 16 Astigmatism is a defect in a person's (a) knees (b) ears (c) spinal cord (d) eyes.
- 17 A good location for the antenna of a television transmitter would be (a) a high place commanding a view of the whole horizon (b) the surface of a broad pond (c) the exact center of a large rotating copper disk (d) the deepest cellar available.
- 18 Cells in bees' honeycombs have the shape of (a) circles (b) squares (c) hexagons (d) triangles.
- 19 "United States standard thread" is (a) the kind of thread found in the paper of dollar bills (b) a widely used type of screw thread (c) sewing thread made exclusively of U. S. cotton.
- 20 Speaking of geography, don't forget that the modern name for Persia is (a) Manchukuo (b) Iran (c) Tanganyika Territory (d) Wilkes Land (e) Liechtenstein.

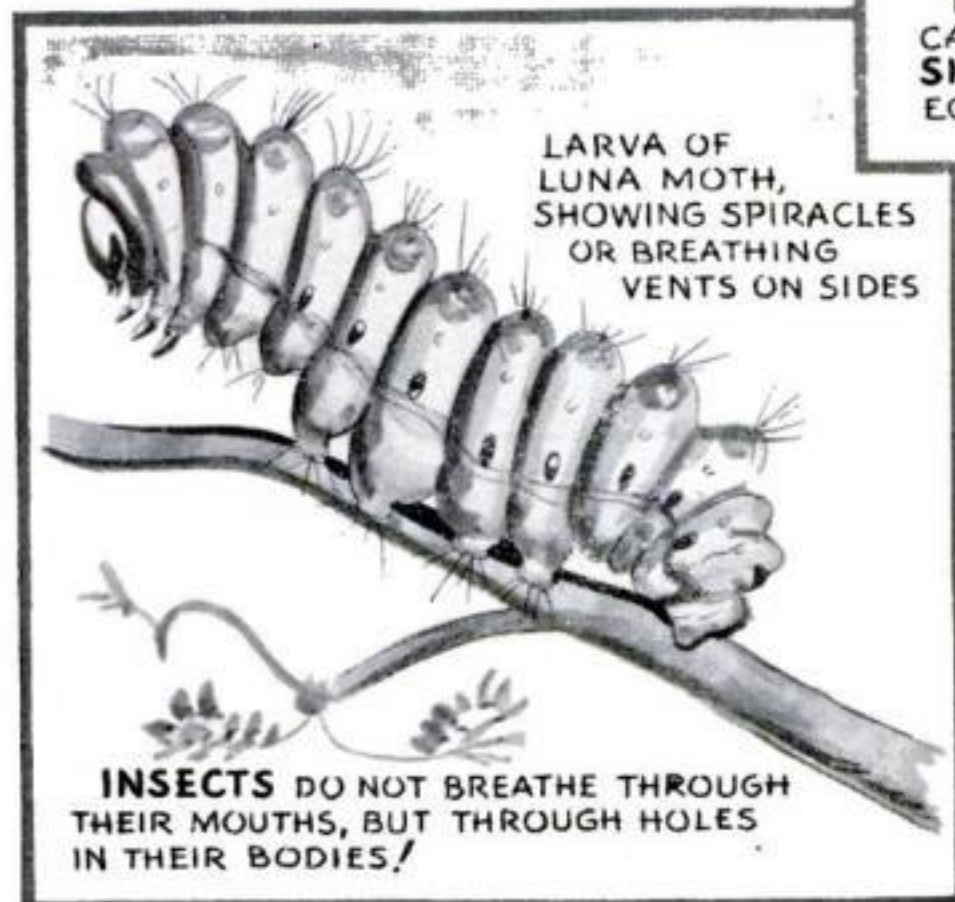
Un-Natural History *By Gus Mager*



MANY KINDS OF **BATS** HAVE A NARROW, CONELIKE MEMBRANE IN THE EXTERNAL EAR! IT IS BELIEVED TO INTENSIFY SOUNDS AND AID THEM IN BLIND-FLYING!

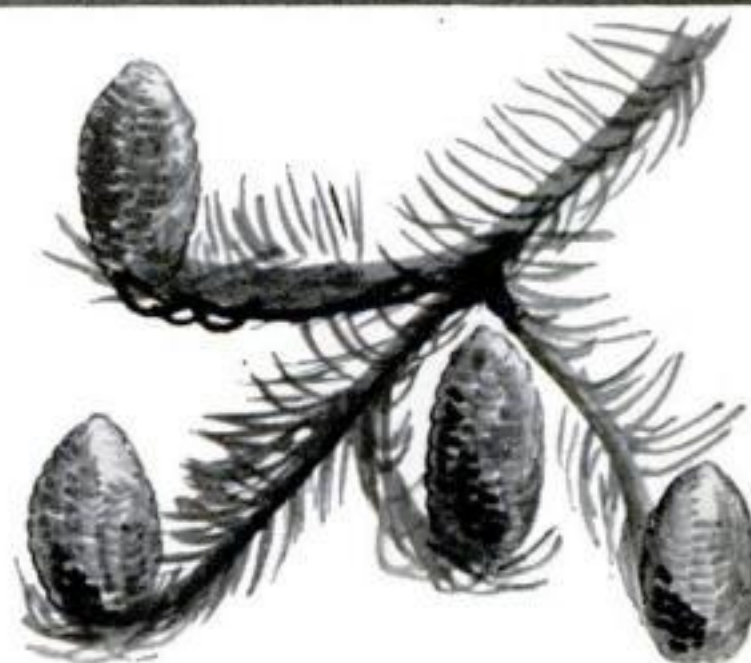


THE MOST LIGHT-FINGERED PICKPOCKET CANNOT MATCH THE FINESSE WITH WHICH **SKUNKS** HAVE BEEN KNOWN TO SNEAK EGGS FROM UNDER SITTING HENS!



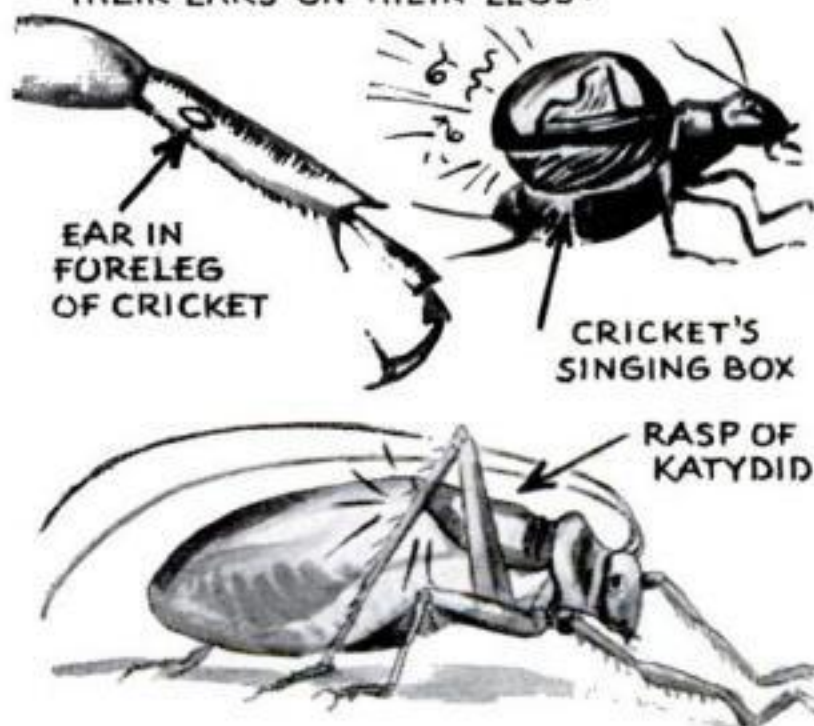
LARVA OF LUNA MOTH, SHOWING SPIRACLES OR BREATHING VENTS ON SIDES

INSECTS DO NOT BREATHE THROUGH THEIR MOUTHS, BUT THROUGH HOLES IN THEIR BODIES!



WOULD YOU KNOW A **FIR TREE** FROM ALL OTHER CONIFERS? THE FIR IS THE ONLY TREE BEARING LARGE CONES THAT CARRIES ITS CONES ERECT!

NEITHER DO INSECTS SING WITH THEIR MOUTHS! THEY HARMONIZE WITH THEIR WINGS, OR WINGS AND LEGS! AND THE ORTHOPTERANS, INCLUDING THE **CRICKETS**, GENERALLY CARRY THEIR EARS ON THEIR LEGS!



EAR IN FORELEG OF CRICKET

CRICKET'S SINGING BOX

RASP OF KATYDID



BIRDS ARE SO ACTIVE THAT THEY GET VERY HOT—TEMPERATURE NORMALLY 104°! SINCE THEIR FEATHERS WON'T LET THEM SWEAT AS WE DO, THEY PERSPIRE INTERNALLY!

"When he touched the door, he got a shock that made him hop!"



Gus Shockproofs a Car

JOE CLARK came out of the Model Garage office and into the shop looking worried. "What's biting you?" Gus Wilson demanded after he had taken a look at his partner's face. "Are we headed for bankruptcy, or is it just something that you ate for breakfast?"

Joe refused to smile. "I'm worried about those tires I sold Vernon Hopkins yesterday," he admitted. "You know how he is—a careful driver, and a little bit of a grouch. He came in while we were having that sleet storm, and said he thought he'd better put on new tires. I wanted to make a sale, of course, but I found his rubber in pretty good shape and told him so. 'Pretty good isn't good enough,' he said. 'I'll put on new tires now and keep the old ones until spring, and wear them out then.'"

"That was all right with me, so I sold him a set and had Harry put them on for him. He was on his way down to the city and didn't want to lug the old ones with him, so he asked me to keep them for him."

"He came back late in the afternoon, while you were out, and he certainly was burning up. He said that after we'd put on his new tires he'd gone down to the city and picked up his wife, and that when she'd put her hand on the door handle to get in she'd got an electric shock that had almost

knocked her down. I told him that I didn't see how the new tires could have been to blame for it, but he insisted that they must have been the cause—that he'd never had any trouble with static before, but that ever since we'd put on the new rubber the body of his car had been so full of static that several people who had touched it had received severe shocks.

"To prove to him that it couldn't be the fault of the tires, I had Harry put his old ones back on the car. Then I went out in it alone for a couple of miles, and, when I got back, I told him to put his hand on the body—thinking, of course, that he'd get a shock. But he said he didn't feel anything. So I asked him to drive for a while, and then I tried it. I didn't get any shock, either, so I had to admit that after all the new tires might have something to do with his trouble.

"I got him to let me put the new tires back on, and then I went out and drove his bus around the block a few times. When I got back here he was waiting for me outside, and before I could get out of the car he had started to open the other door to get in. When he touched it he got a shock that made him hop—and that made him so darned mad he swore he'd never give us another dollar's worth of business unless I took those tires off and gave him back his money.

After a lot of arguing back and forth, I managed to get him to agree to leave the new tires on and bring the car in today so that you could have a look at it."

Vernon Hopkins drove into the shop a little later. The expression on his thin face showed that he still was well charged with bad temper, so Gus judged that his car still was well charged with static—and when he touched it he took a wallop which showed him that he had judged correctly.

Hopkins was talking loud and fast as he got out. "Shucks, man," Gus told him with his disarming grin, "there's no sense in getting yourself all steamed up about a little static. All we've got to do is give it an easy chance to get out. I'll have you fixed up in three minutes. Take it easy!"

He went over to his workbench and got a carpenter's pencil with a soft, thick lead. With it he drew a half-dozen lines on the inside of each tire, starting at the rim and running across the wall of the tire to its tread. Then he took a little ride. After driving for a mile or so he returned to the garage.

"Touch your hand to the body of the car now," he said. "If you get a shock, Joe'll give you your money back and I'll add a five-spot to it for your trouble. That's fair enough, isn't it?"

Hopkins grunted and touched a finger gingerly to the car body. Then he put the palm of his hand against it, and smiled for the first time that day. "You've killed it," he admitted. "But how, I'd like to know. Just making marks on the tires doesn't make sense to me, but it seems to work."

Gus laughed. "When I was a grease monkey," he said, "we used to think it was a swell joke to take a soft lead pencil and draw a line from the top of a spark plug down the porcelain onto the head. That made the plug foul out and the engine stall, and the owner couldn't find out why. I figured that if a lead-pencil line on a spark plug would carry that much juice, a lead-pencil line on your new tires would ground out the static generated by them."

Gus then used a disk of waterproof graphite to replace the pencil lines with heavier marks which wouldn't wash off. "That'll kill your static devil for good," he assured Hopkins, "and I'll guarantee that he'll never bother you again."

Joe Clark, who diplomatically had kept well out of the irate customer's way, stuck his head in at the shop door after

he had driven off. "What did you do to smooth him down?" he wanted to know.

"Oh, I just drew a few straight lines—in the right places," Gus told him. "You can stop worrying, Joe. You won't have to punch the refund key on your cash register for that sale. . . . I'm going down town and get my lunch."

When he got back he found a scratchless and speckless small sedan in the shop, and a formidable-looking stout lady sitting in its back seat. As soon as she saw him she lowered a window and demanded shrilly: "You the mechanic here? Your boss said you'd be back at one o'clock, and here it is almost half past. Well, now you're here, do something! I'm sick and tired of wasting time."

"All right, ma'am," Gus said meekly. "But what is it that you want me to do?"

"Don't ask *me!*" she snapped. "I don't drive this thing." She poked a scornful forefinger at a harried-looking man who was coming out of the office. "Ask Mr. Coville—*him!*"

Coville waited for Gus to come over to him at the office door—obviously he wanted to stay as far away from the car and its occupant as he could. "I'm having bad trouble with my radiator," he said in a cautious voice, "and my wife is all upset about it. I'm hoping that maybe you can help me out."

"I'll be glad to. That's my job," Gus told him. "But while I'm doing it, wouldn't your wife be more comfortable in the

office? It's much warmer in there."

The new customer looked more harried than ever. "Yes, she would," he almost whispered. "And I'd be a lot more comfortable if she'd go in there. But she won't. I don't know much about cars, and she knows that I don't. She wants to sit there where

He drew a half dozen pencil lines on the inside of each tire



A Customer's Car with a Bad Case of "Static" Has Gus Hopping for Awhile, But He Cures It with a Lead Pencil

• • •
By MARTIN BUNN

she can hear every word you say, so she'll have a good chance to bawl me out if I've pulled a boner. You know how it is."

Gus grinned. "No, I wouldn't know—I'm a bachelor," he said. "But I'm a pretty good guesser. Tell me what's the matter, and if the bull is on you, I'll cover you up."

The other looked relieved. "Well," he explained, "I was driving along about forty miles an hour a ways back when I heard a noise somewhere up front—sounded like some one had hit the hood with a pebble. I didn't think anything much of it, but before we had gone a half mile, I saw the hand of the heat indicator jump right up into the red. Just then I saw a garage sign a little way down the road, so I drove in there.

"When I told the mechanic about the heat indicator, and about the noise I'd heard, he said that probably my fan belt had snapped. But when he opened the hood he found that the belt was all right, although the motor was very hot. Then he said that the fan belt must be slipping, and he tightened it. He poured some water into the radiator, but it ran right out, and he said that it was coming out of the overflow pipe which showed that the radiator was full, and that with the fan belt tightened the motor soon would cool off.

"I started off again, but the heat-indicator hand didn't go down to where it belonged, and before I'd driven a quarter of a mile the motor was so hot that it was smoking. I stopped and waited for it to cool off, but after a half hour the heat-indicator hand still was up in the red. All the time we had been standing there the wife had been bawling me out, and I was so darned tired of listening to her that I decided I'd make it to the next garage even if I burned up the motor. Luckily it was all downhill to your place, so I shut the motor off and coasted. We've been here pretty near an hour, but she's still hot—the motor, I mean."

"I'll have a look," Gus told him. When he raised the hood and examined the radiator he whistled. "Probably bone-dry!" he said. The hose connections seemed tight. When he checked the oil he found it free from water, so the trouble couldn't be the result of a leaky water jacket. Suddenly he reached deep under the hood, lifted something out,

glanced at it keenly, slipped it into his pocket, fussed around the bottom of the radiator for a few seconds, and then straightened up and winked at the worried car owner.

"I've found your trouble, Mr. Coville," he said loudly, for the benefit of the lady on the back seat. "It was quite unavoidable,

and the sort of accident that happens only once in a hundred years. No wonder you couldn't locate it. Fortunately there is no damage done, and I'll have you fixed up in a jiffy."

He brought a hose over to the car. "Start the engine, please," he asked. The radiator took a lot of water. "Now you'll be all right," he said when it was filled. "Leave your engine idling for a few minutes, and you'll soon see that she's normal again. If you'll step into the office. . . ."

Coville gave his wife a triumphant glance and

followed him. "What was it?" he asked when they were out of earshot of the lady in the back seat. "I saw you wink at me."

Gus laughed as he took a small pebble out of his jumper pocket. "When I found this it was the tip-off," he said. "It was a pebble that made the noise you heard, and caused all your trouble. It flew up from the pavement past your crankcase; probably hit your fan. The fan was turning pretty fast, and it threw it against the radiator drain cock, which is of the screw type, with so much force that it spun the cock wide open. Naturally, all the water ran out of your radiator in a few seconds, and your engine heated up like nobody's business."

"I'm downright relieved," Coville said. "I thought it was going to be another of those things that I never hear the end of. But say—why didn't the mechanic at the first garage I stopped in spot the trouble? He told me that the radiator was full."

"Well, things like that are bound to happen now and then," Gus said tolerantly. "He jumped at conclusions, which always is dangerous in this business. When he put water in your radiator and it ran right out again he took it for granted that it was running out through the overflow pipe. But it really was running right through the radiator and out at the drain cock."

"Well, I'm certainly relieved," Coville said. "I'm a new customer but you can bet I'm going to be (Continued on page 244)

GUS SAYS:

Here's a good tire policy to stick to: Put tires with the most tread on the rear for winter driving. Avoid, if possible, uneven wear on the two front or two rear tires. Never drive on any tire that you are the least suspicious of. Check the pressure often.

THE HOME WORKSHOP



In This Issue... **BOAT BUILDING • RADIO • FURNITURE
TOOLS • CAMERA KINKS • HOME LABORATORY**

Family

A FAST, SAFE

SMOOTH riding and absolute safety at high speeds characterize this new 13½' round-bottom outboard runabout. Well adapted to both rough and smooth water, it may be used efficiently with any outboard motor of from 1 to 60 h. p.—a power range that can be achieved only with a round-bottom design.

Even if it should be recklessly driven, the boat is practically impossible to upset at any speed, excepting only in extremely high seas such as would be too much for any small boat. It is large enough to carry the whole family safely and comfortably, easy to row, and so light that two men can lift it onto a trailer.

The design includes various features never before offered in a boat for home construction. The combination of rocker keel forward, and flat planing surface aft, and the complete elimination of tripping chines make



**THIS
13½-FOOT
ROUND-BOTTOM
OUTBOARD
SEA SKIFF
RIDES VERY
SMOOTHLY
AND WILL NOT
CAPSIZE,
EVEN IN
ROUGH WATER**

●



The boat will do better than 25 m.p.h. with a 16-h.p. outboard. Deck and seats may be arranged to suit individual preferences and size of motor

Runabout

ALL-PURPOSE BOAT

the design the safest it is possible to build. Clinker-built (lapstreak) construction with bent oak frames provides for exceptional light weight and strength. At high speed the spray is caught by each plank lap and forced back under the boat, both increasing speed and preventing flying spray.

Any one of four standard types of construction may be used. If made lapstreak, the hull will be found no more difficult to build than many V-bottom boats of the same size. The other three methods are somewhat more difficult for the amateur, but will be described briefly.

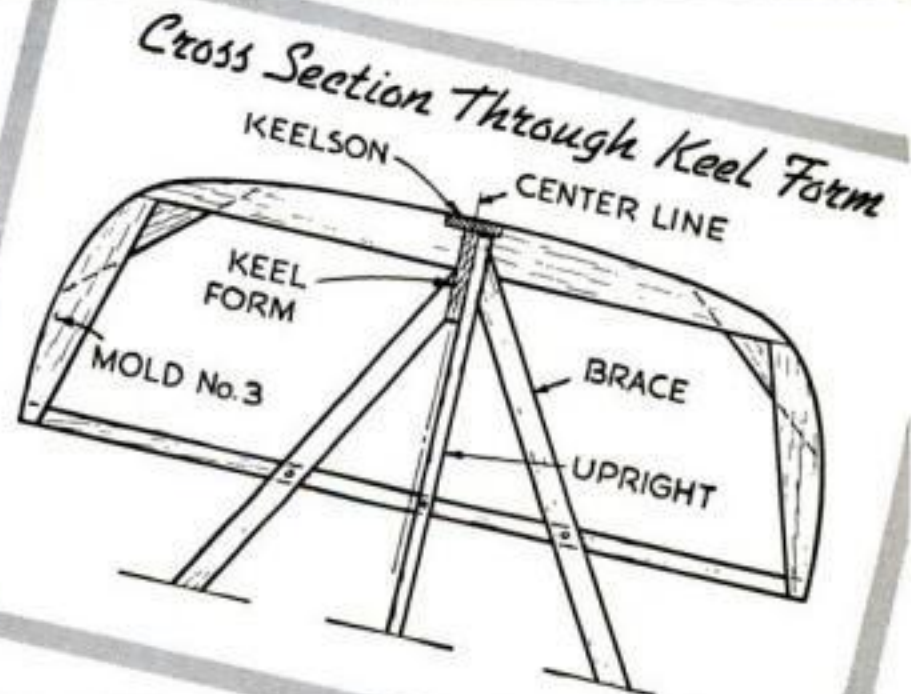
Cost will range anywhere from \$40 to \$50 complete, depending on the materials selected. The cost may be reduced if resawed lumber is obtainable for planking. If built entirely of cedar and spruce, except for the bent ribs, the weight will be 250 lb. or less, and it

should not exceed 350 lb. with the use of any of the materials listed.

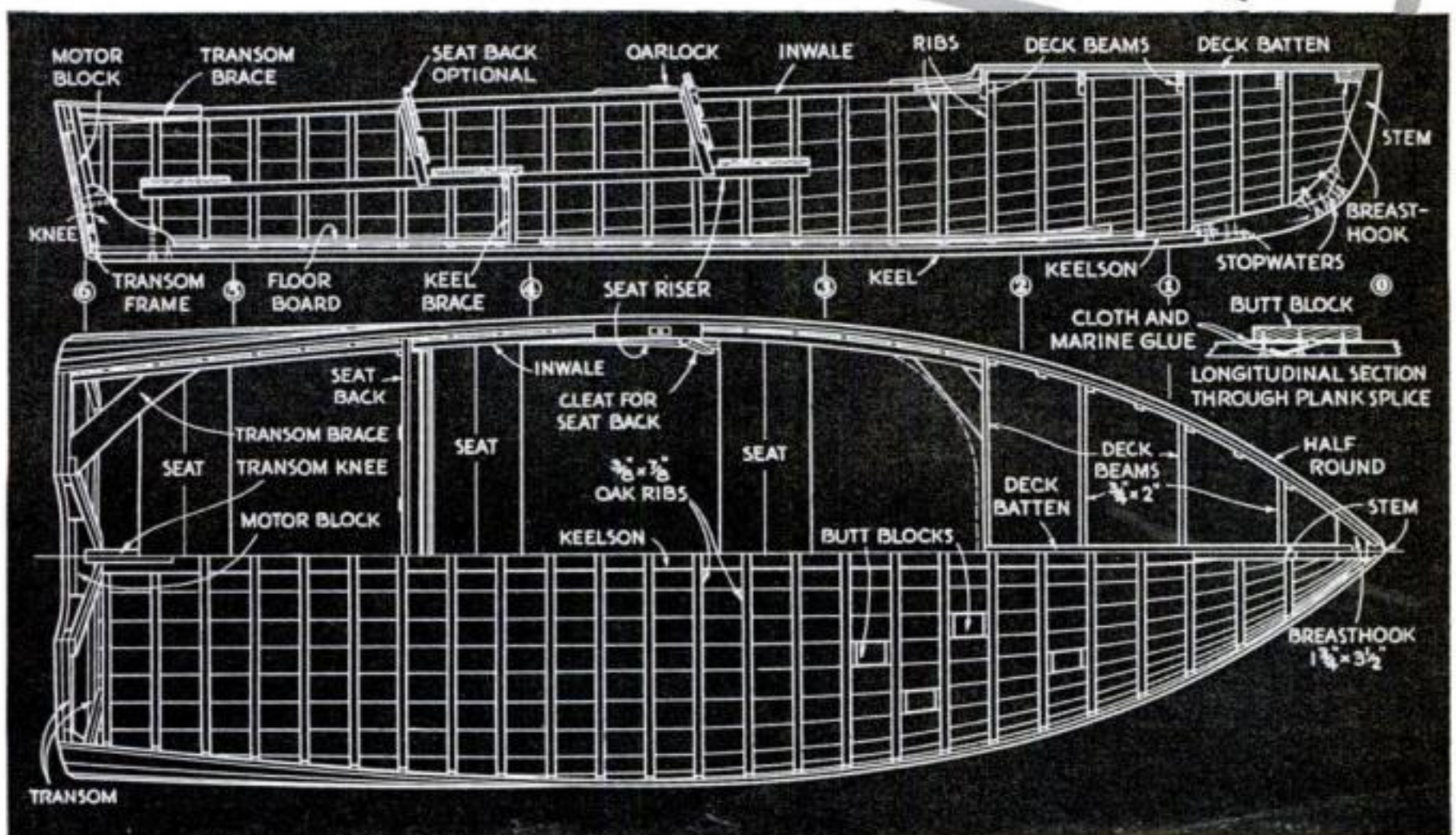
The speed obtained will, naturally, depend upon the size of motor and the load carried. With two persons aboard it will make on the average 7 m.p.h. with 2 h.p., 10 m.p.h. with 5 h.p., 15 m.p.h. with 9 h.p., 25 m.p.h. with 16 h.p. and 30 to 35 m.p.h. with 22 h.p. The boat may be used safely with the very fastest racing motors, if desired, for speeds up to 45 m.p.h. It qualifies for racing in the outboard runabout class, but is

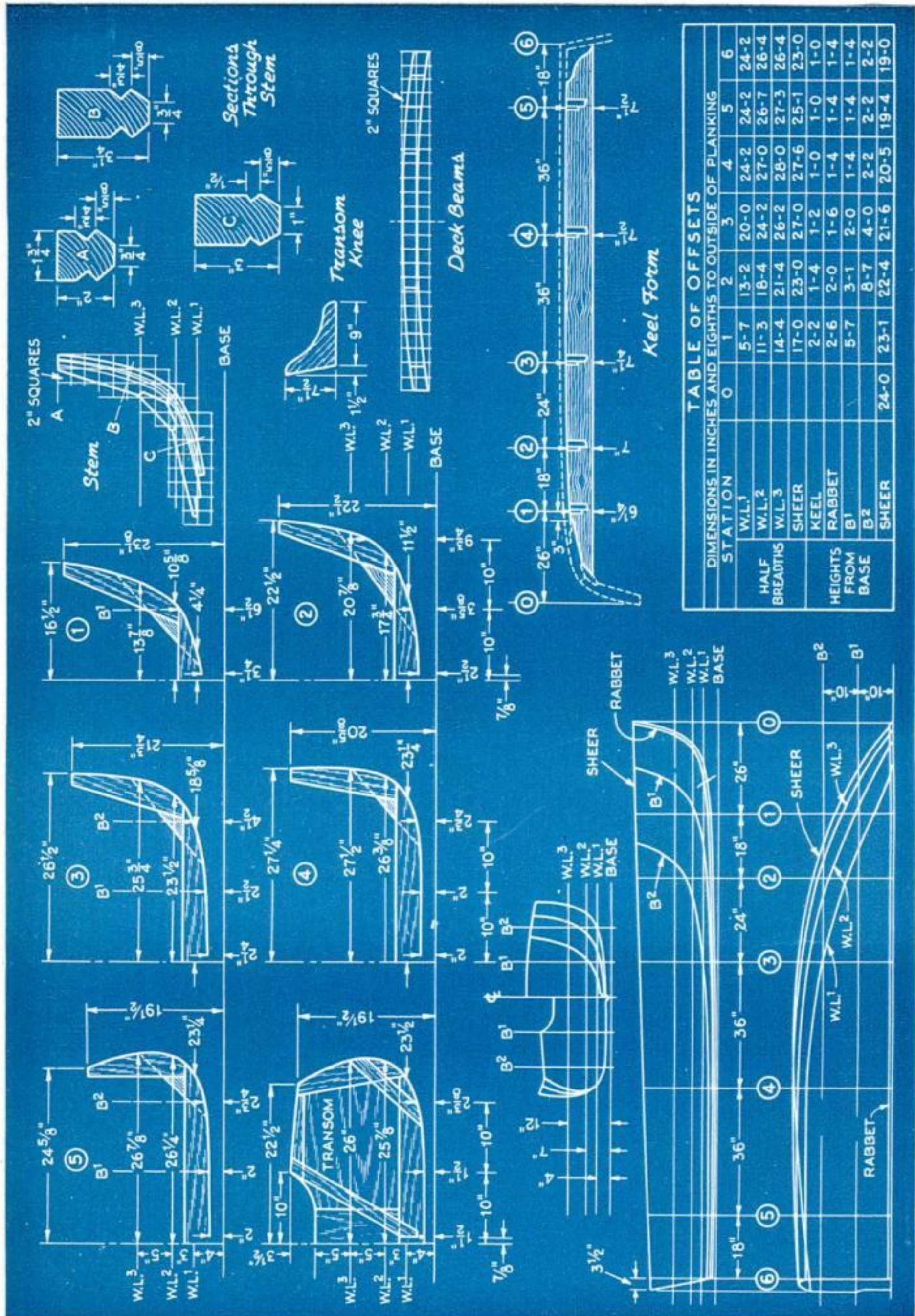
Facts About The New Outboard Sea Skiff

LENGTH (OVERALL)	13'-5½"	DEPTH AMIDSHIPS	20½"
LENGTH (WATER LINE)	12'-5½"	COST OF MATERIALS	\$40
BEAM	56"	WEIGHT	275 LB.
DRAFT	3"	PASSENGERS	6
FREEBOARD (BOW)	20"	MOTORS	1 TO 60 H.P.
FREEBOARD (STERN)	15"	SPEED	5 TO 45 M.P.H.



By **BRUCE and
WILLARD CRANDALL**



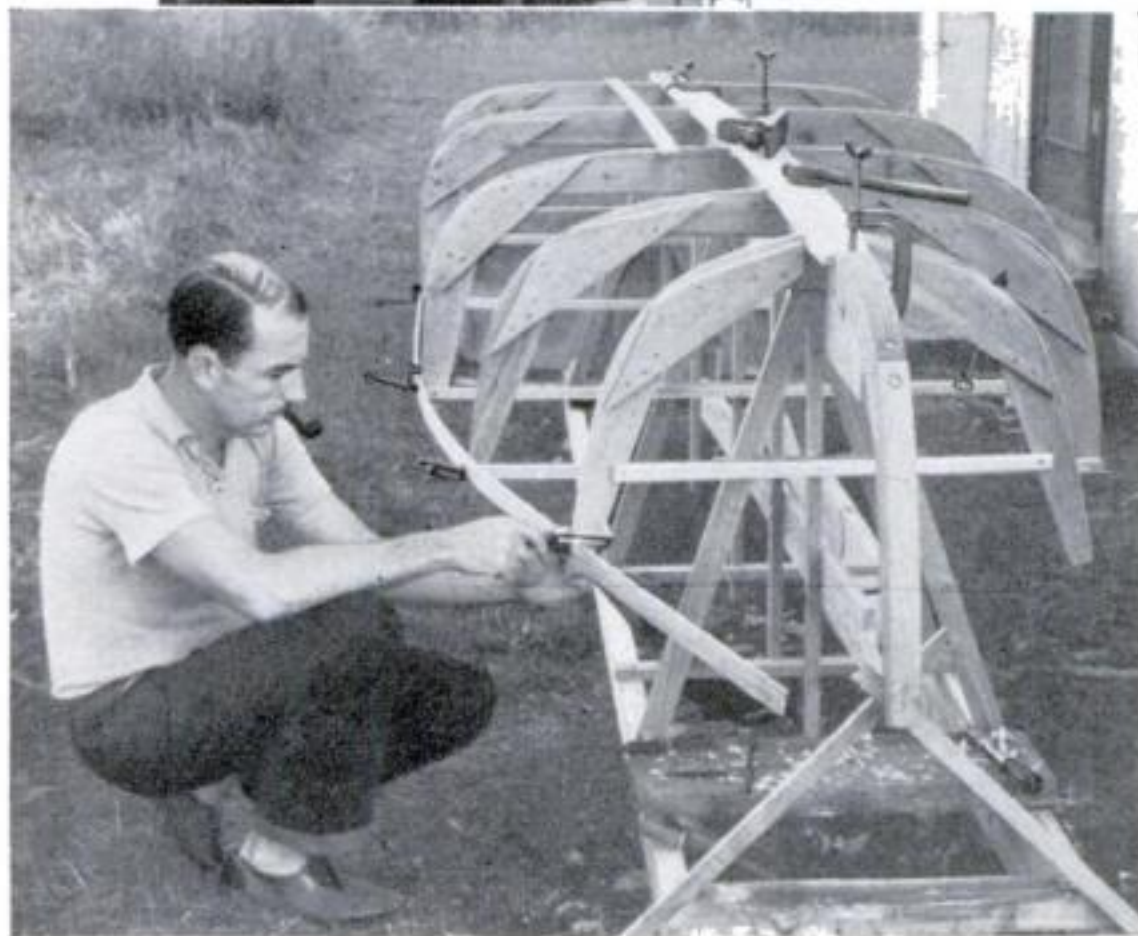


Molds, stem, and other details. A full-size layout may be made, if desired, by using the table of offsets

The keel must be screwed to the keelson, and temporarily to the keel-form plank in several places



The parts of each mold are placed over the full-size paper pattern while they are being securely fastened together



A light batten is bent over the molds in various places to see that there are no irregularities to cause difficulty in planking

the assembled mold and fold in the middle in such a way that the fold will represent the center line. Draw the base line and the three water lines at right angles to the center line and draw the two buttock lines (*B1* and *B2*) parallel to the center line. Use the measurements from the drawings of the molds and transom. Now draw the shape of the mold by using a light batten bent into position to form a true curve, and held with small brads. Then punch through the paper at the important points, unfold it, and draw the other half.

The full-size pattern is placed over the material from which the molds are to be made, and the outline of the shape transferred with a marking wheel. The pieces can then be sawn out and

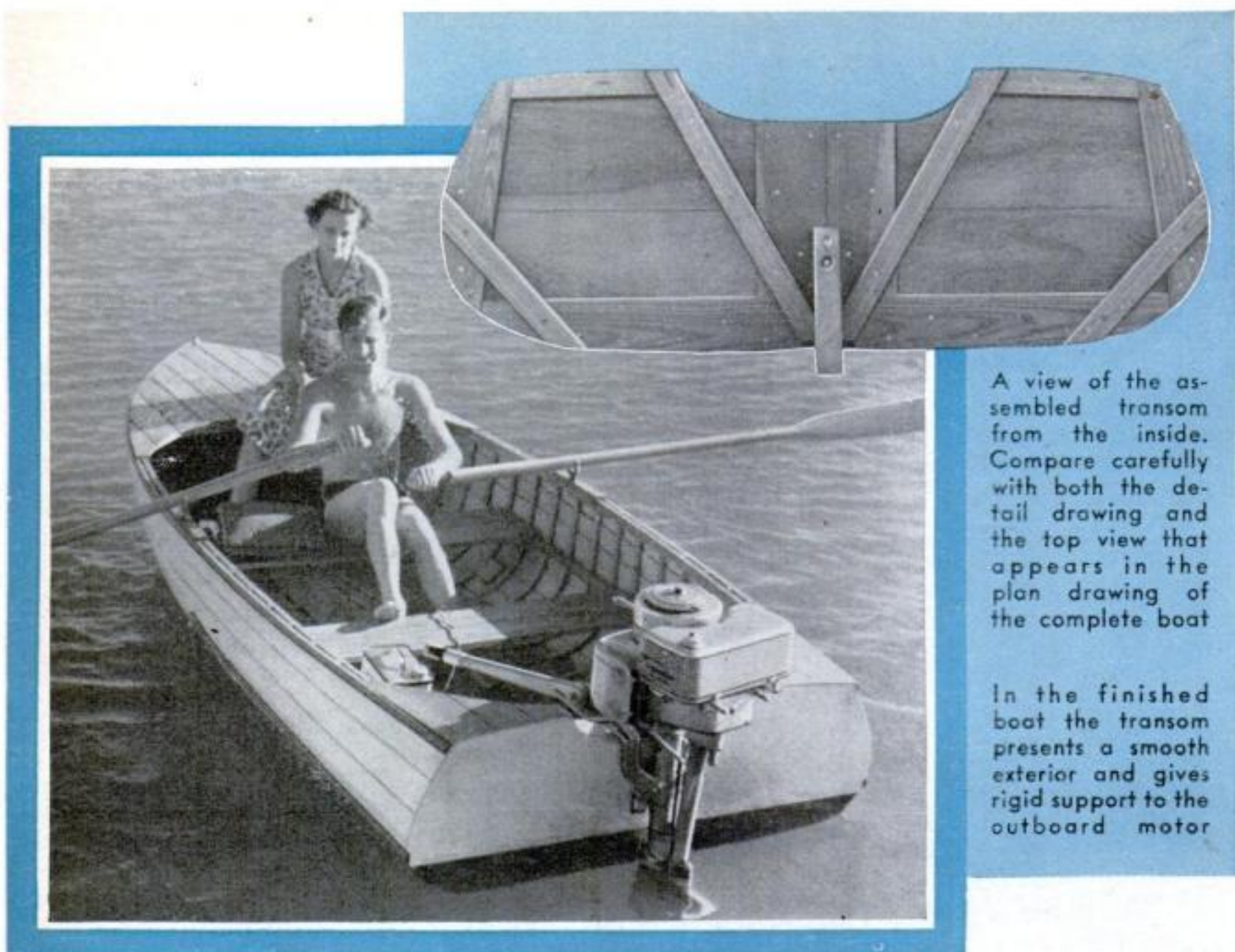
not as fast as our racing runabout (covered in P. S. M. plans 261-262-R.)

If desired, the entire boat may be drawn full size before starting construction by using the measurements given in the table of offsets and accompanying drawings, and deducting the thickness of the planking from the full-size drawings. This is not essential, however, as this work has already been done. It is necessary only to make full-size patterns of the molds, stem, and transom, or the patterns may be purchased already drawn.

For the drawing of each pattern, use a sheet of wrapping paper large enough for

planed to shape. The various parts should be in position over the patterns while they are being fastened together. The transom is laid out in the same way as the molds. The transom planking should be screwed to the transom framework and motor blocks with $1\frac{1}{4}$ " No. 8 screws spaced about 3" apart, the surfaces to be joined first being coated with marine glue or thick paint.

Nail strips across the top of the molds and mark the center line on these strips and at the bottom of each mold. Notches for the keelson can now be cut in the exact center of each mold and in the bottom transom



A view of the assembled transom from the inside. Compare carefully with both the detail drawing and the top view that appears in the plan drawing of the complete boat

In the finished boat the transom presents a smooth exterior and gives rigid support to the outboard motor

frame but not the planking of the transom.

Make the stem in three pieces from $1\frac{3}{4}$ " stock and check it over the full-size pattern before fastening them together. Fasten the two parts of the stem to the knee with two 4" carriage bolts and four 2" No. 10 screws. Two softwood dowels are driven through for stopwaters at the points shown in the drawings.

The boat should be built upside down on a framework supported from the floor, or from two timbers as shown in a photograph. The essential part of the framework is the keel form on which the keelson, stem, molds, transom knee, and transom will rest. Make the keel form from a 1" by 8" plank according to the measurements given in the drawing, and cut notches where the molds will rest. These notches should be deep enough so that each keelson notch will be flush with the edge of the keel form. Nail uprights to the keel form at each station and set the form up at a convenient height for working, braced as shown. The uprights must be perfectly plumb and at right angles to the keel form. The molds should be set in notches and temporarily fastened to the uprights in such a way that their center lines are perfectly plumb and at the center of the keel form. These molds serve the pur-

pose of holding the boat in shape while it is being planked, but are discarded before the boat is finished.

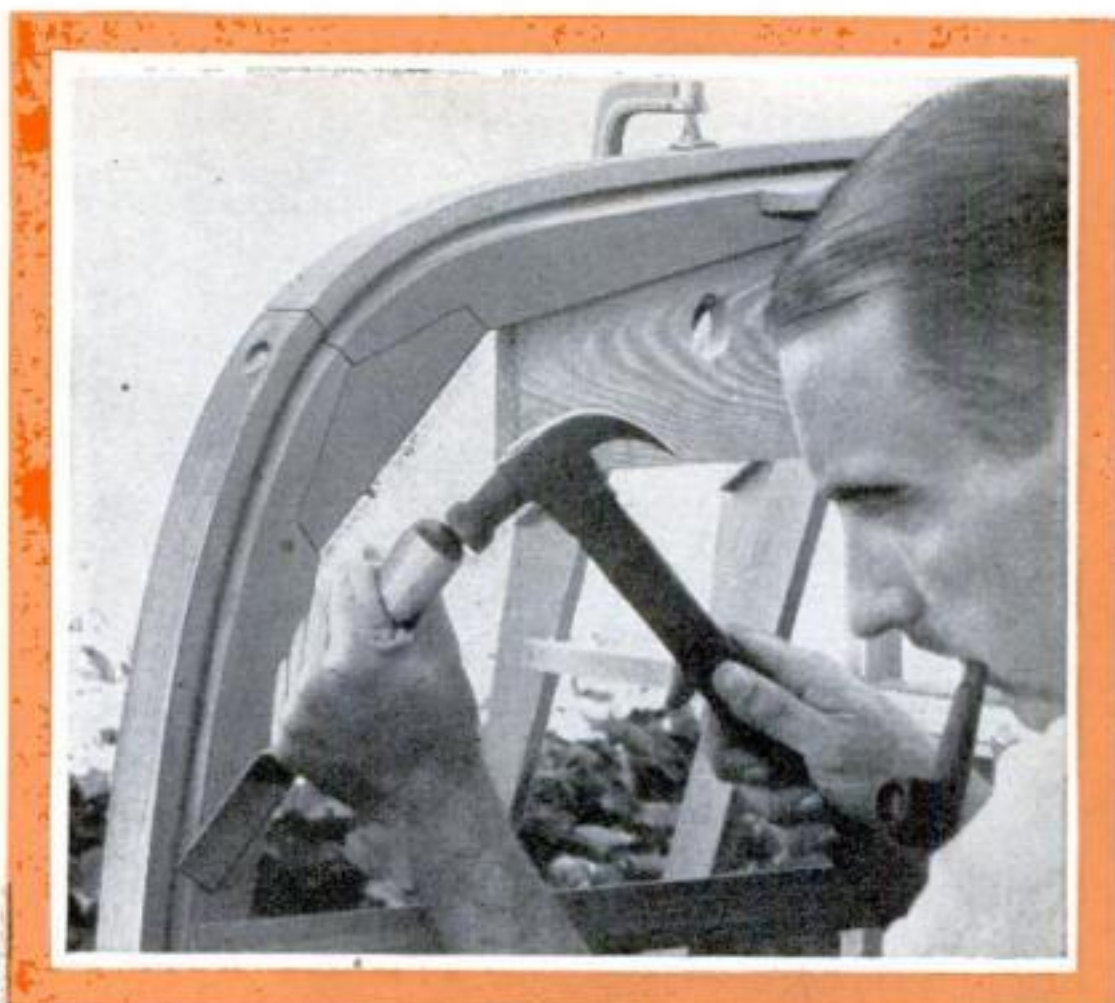
The keelson, stem, transom, and transom knee may now be set up. Clamp the keel temporarily in position on the keelson in order to determine the extent of the bevel of the keelson. Taper the keelson where it joins the stem. After making sure that the transom and stem are in perfect alignment, screw the keel and keelson to the stem, transom, and transom knee with $1\frac{1}{4}$ " and $1\frac{3}{4}$ " No. 8 and 2" No. 10 screws. The transom knee is also screwed to the transom and fastened to transom and keel with $\frac{1}{4}$ " by 4" bolts. The keel should be fastened to the keelson about every 6" with $1\frac{1}{4}$ " No. 8 screws, about half of which are screwed from the inside. The joining surfaces should be coated with marine glue or thick paint before fastening. The keel will have to be fastened temporarily to the keel form in several places with about 3" roundhead screws, which will be removed and the holes plugged when the boat is taken off the keel form.

Make sure that the stem is in perfect alignment and that the molds and transom are at right angles to the keel; then brace them all in position and check with a light batten, bent over the molds in various

places, to make certain there are no irregularities in the shape of the boat. The rabbet may now be cut in the stem to the thickness of the planking to be used. A light batten bent over the molds in the direction the planking is to go will give the correct angles. The transom must also be beveled to fit the planking.

Now, if the boat is to be constructed according to the lapstreak method, it is ready for the planking, as the planks will all be fastened together at the laps and the bent ribs put in after the boat is turned right side up. Smooth-built construction methods will be discussed later.

(TO BE CONTINUED)



When traveling at high speed, the sea skiff automatically banks as it starts to make a sharp turn



MATERIALS FOR THE UTILITY RUNABOUT

Note: This list is based upon lapstreak construction and the seating arrangement shown in the photographs. The kinds of woods are given in the order of preference.

LUMBER

White cedar, mahogany, red cedar, cypress, white pine, fir, spruce, or redwood.

For	No.	Pc.	Size
Planking	18	$\frac{3}{8}$ "* or $\frac{1}{2}$ "*	$6'' \times 14'$
	6	$\frac{3}{8}$ "* or $\frac{1}{2}$ "*	$8'' \times 14'$
Decking	4	$\frac{3}{8}$ "*	$4'' \times 16'$
Floor boards	4	$\frac{3}{8}$ "* or $\frac{1}{2}$ "*	$6'' \times 10'$
Transom	1	$\frac{3}{4}$ "*	$10'' \times 10'$
Seats	2	$\frac{3}{4}$ "*	$6'' \times 14'$

Spruce, oak, mahogany, fir, yellow pine, cypress, cedar, white pine, or redwood.

Keel	1	1"*	$1\frac{3}{4}'' \times 12'$
Keelson	1	$\frac{3}{4}$ "*	$3\frac{1}{2}'' \times 12'$
Stem, knee, and breasthook	1	$1\frac{3}{4}$ "*	$3\frac{1}{2}'' \times 4'$

For	No.	Pc.	Size
Transom frame and braces	1		$\frac{3}{4}'' \times 3\frac{1}{2}'' \times 16'$
Transom knee	1		$1\frac{3}{4}'' \times 8'' \times 1'$
Inwales and seat raisers	2		$\frac{3}{4}'' \times 1\frac{1}{4}'' \times 16'$
Molding (half-round)	2		1" x 16'
	1		1" x 10'

White oak

Ribs	25	$\frac{3}{8}$ "*	$\frac{7}{8}'' \times 8'$
------	----	------------------	---------------------------

Any cheap lumber

Keel form	1	1" x 8" x 12'
Molds	3	1" x 4" x 16'
Uprights and braces	4	1" x 2" x 16'

*These measurements are net.

HARDWARE AND MISCELLANEOUS

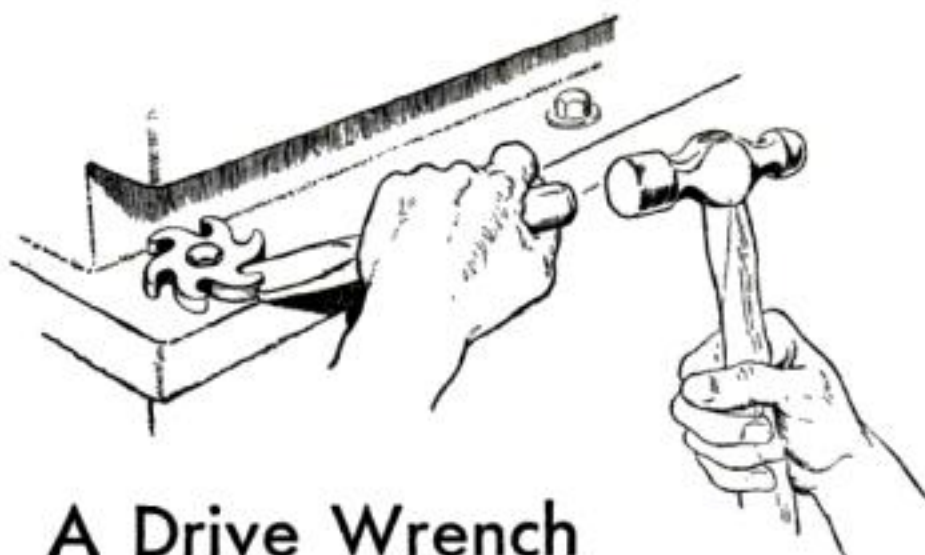
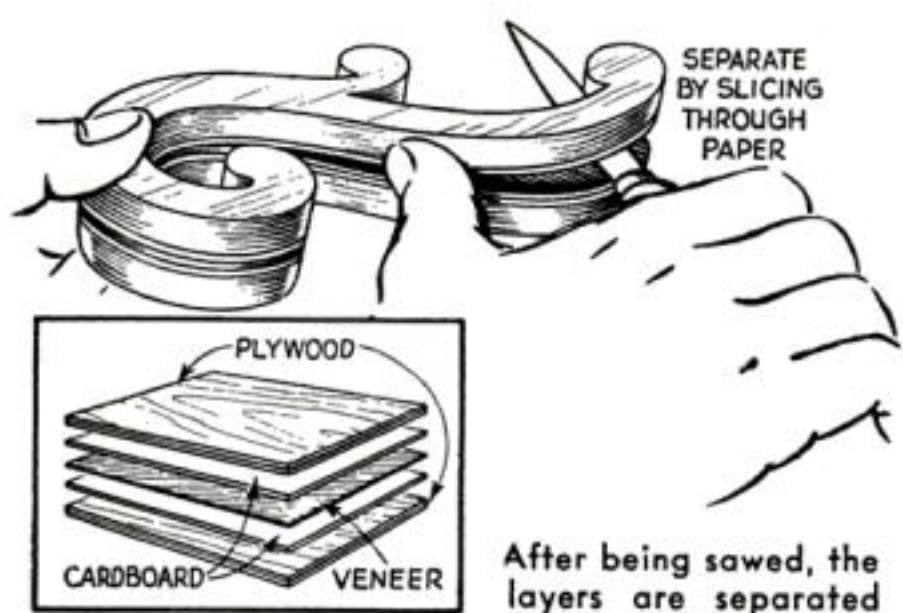
Flathead brass, galvanized, or cadmium-plated screws as follows: 6 gross 1" No. 7, 2 gross 1 $\frac{1}{4}$ " No. 8, 6 doz. 1 $\frac{3}{4}$ " No. 8, 6 doz. 2" No. 10. Copper nails and burrs, or galvanized nails, as follows: 4 lb. 1 $\frac{1}{4}$ ", and 1 lb. 1 $\frac{1}{2}$ ". Also 4-5" x $\frac{1}{4}$ " galvanized carriage bolts; 1 qt.

marine glue (aviation or C-quality); 5 yd. cotton flannelette; 3'- $\frac{3}{8}$ " by 3/16" half-oval brass, aluminum, or galvanized iron; 1 gal. marine paint; 1 qt. spar varnish; 1- $\frac{3}{8}$ " by 2 $\frac{1}{2}$ " shoulder screw-eye bolt; 1-4" open-base cleat; 1 pr. oarlocks.

Cutting and Shellacking Delicate Inlays

VERY small, delicate designs can be jigsawed from veneer for inlaying if a thin plywood backing is first glued to each side with pieces of heavy paper or cardboard glued between. After being sawed, the veneer can be separated by slicing gently through the paper. Several identical pieces can be cut at one time by this method.

When the wood into which the inlay is to be set is to be stained before finishing, cover the faces of the veneer with a thin coat of shellac before gluing the "sandwich" together and shellac the edges after the pieces are cut.—J. BRUMFIELD.



A Drive Wrench for Close Quarters

THERE are countless different types of wrenches on the market, yet a new style or idea develops every now and then. Recently the writer made up a set of six standard-size wrenches of the type shown, as well as a notched drift to drive them. These wrenches can be used where a nut is hard to get at and are particularly useful for starting stubborn nuts.—CHARLES WILLEY.

\$100 in Prizes for Letters

Your chance is as good as the next reader's to win a prize in our new contest. See "Our Readers Say" Department in this issue for full particulars.

Rope-of-India Smoking Stand Provokes Curiosity

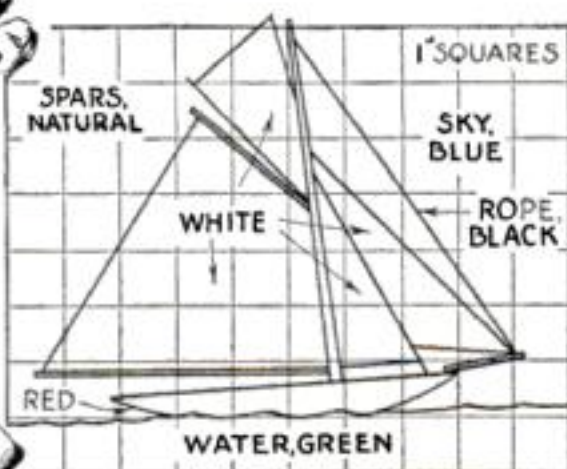


The rope, which appears to support the stand, really has a core of $\frac{1}{4}$ " steel rod

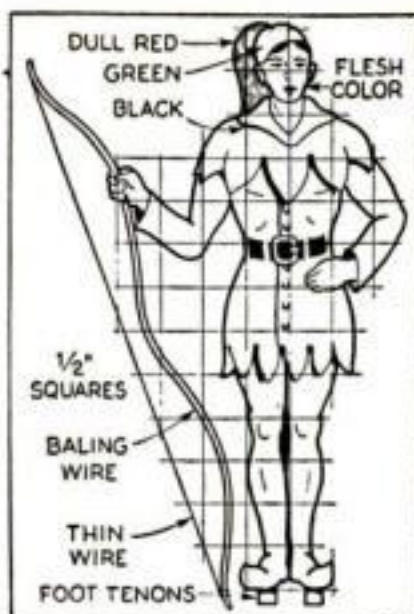
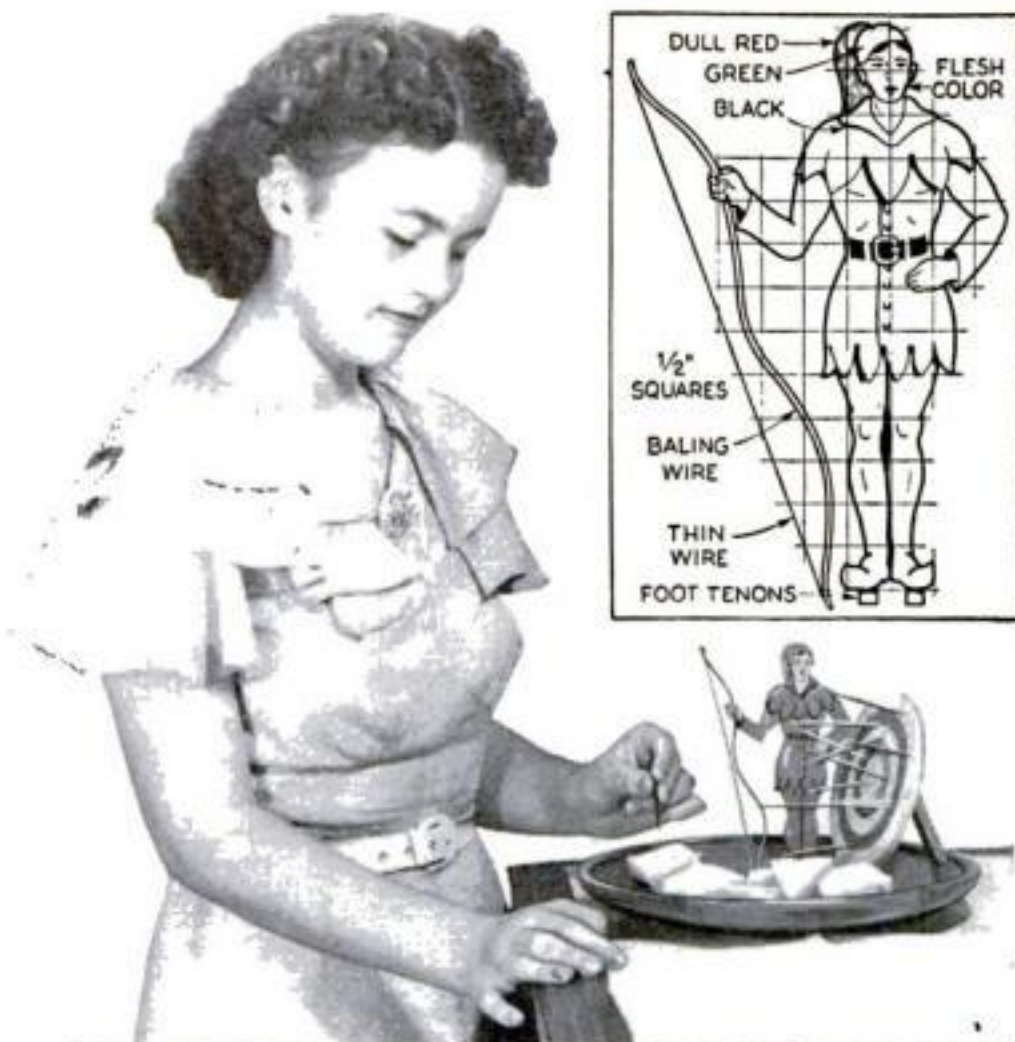
REMINISCENT of India's famous rope trick, this smoking stand appears to be supported by a piece of rope. The base is made of two pieces of $\frac{1}{2}$ " by 1" oak, 15" long, fastened with a cross-lap joint. The tray support is of the same material and construction, but only 8" long. A $\frac{1}{4}$ " rod is threaded on both ends so it can be screwed into a tight-fitting hole in both the base and the tray support. The tray or top is $\frac{3}{8}$ " plywood, the edges being covered with $\frac{3}{8}$ " rope, tacked on with small wire brads.

A length of $\frac{3}{4}$ " rope is now placed on the rod. First whip or bind one end with cord; then grasp this end firmly in one hand, and about a foot up the rope with the other hand; next twist against the direction of the strands.

This will cause the strands to separate, and the rope may then be slipped over the rod. At the top of the rod, the rope is again whipped. Stain the wood, and varnish. Shellac all rope. A cigarette humidor to match is made by coiling and stitching $\frac{3}{8}$ " rope tightly about an empty tin can.—RALPH E. DASCHKE.



Jig-Sawed Archer Guards Unique Canapé Tray

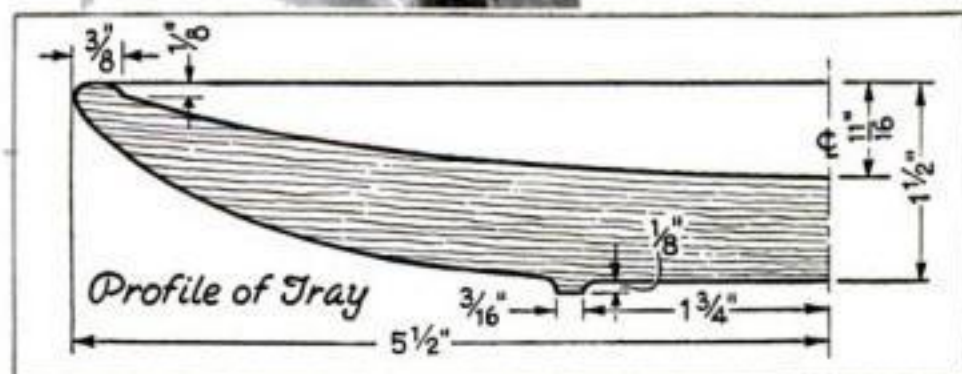


AN ARCHER in Lincoln green stands proudly beside his target on this novel canapé tray. The picks are his arrows, grouped around the golden bullseye.

Any well-figured hardwood is suitable for the tray. Red gum, which requires no filler, is handsome when finished with clear varnish or lacquer, and was used for the tray illustrated. Turn the bottom of the tray at moderate speed. It is then necessary to remove the work from the lathe and reverse it. To make centering easy, turn a $\frac{1}{4}$ " plywood disk to fit the bottom recess, loosen the screws, and force the disk into the cavity. Tighten the screws and shape the tray top. Smooth it down with sandpaper.

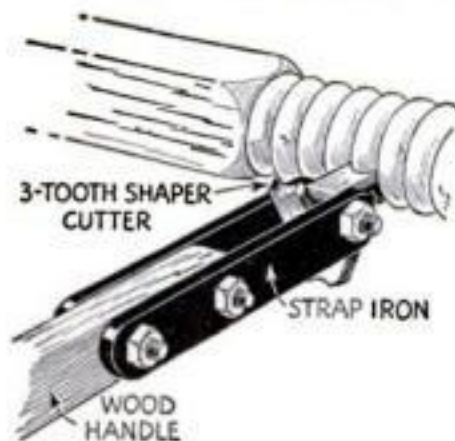
Draw a pattern for the archer, transfer it to hardwood plywood, and jig-saw to shape. Paint him light green, with the cap feather dull red and the details in black. The bow is baling wire, bent to shape, passed through a hole in the man's hand, and strung with thin wire.

The target and legs are cut in one piece. Punch the pick holes at random with an awl. Make the back prop so that the target leans back about 20 deg. from the vertical. Paint the bullseye gold; the rings (from center outward) red, light blue, black, and white; and the feet and prop, green.—E. M. L.



Cross section of tray, which is turned on a lathe, and, above, completed novelty and diagram of archer

Shaper Cutters Utilized as Wood-Turning Tools



Method of mounting a cutter of the proper shape to turn beads on a wooden spindle

WHEN a few beads or other duplicate contours are required in turning wooden furniture spindles, time can be saved by utilizing a standard three-toothed shaper cutter. Mount the cutter at the end of a wooden handle by means of two pieces of strap iron and three bolts, as illustrated.—C. B.



Graphite Lubricates Tip of Soldering Iron

AFTER an electric soldering iron has been in use for some time, the tip becomes corroded. To prevent this, dust ordinary graphite or plumbago in finely powdered form over the threads inside the copper tip each time the latter is changed.—O. B.

Cork Used as a Shaker Top

A SHAKER top for a bottle can be made by using a cork with a small hole burned through it with a hot nail. When not in use, plug the hole with a match stick.



The SHIPSHAPE

A large log floating in a lily pool will prevent the concrete walls from being cracked by the tremendous pressure of ice in a long-protracted spell of freezing weather. It heaves up and relieves the strain at the sides



SANDPAPER GIVES GRIP ON TIGHT JAR CAPS

In the absence of a suitable jar-lid remover, stubborn jar caps can be turned by using a piece of sandpaper to give a grip on the smooth metal



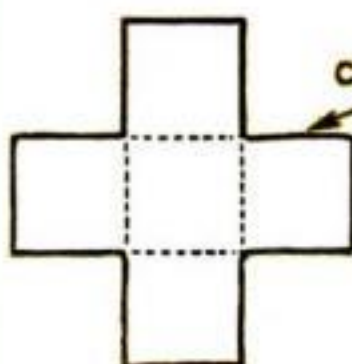
RUBBER CRUTCH TIP PADS END OF BROOM HANDLE

A rubber crutch tip on the end of a broom or dry-mop handle gives a better grip and protects the walls and furniture



Liquid soap can be dispensed by using a small ear syringe. A rubber suction cup is fastened firmly to the syringe with rubber cement so it can be attached to the wall above the wash basin

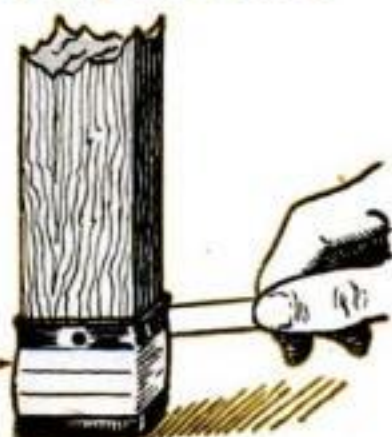
Ironing-board legs often mar a linoleum or hardwood floor. This can be avoided by padding them with pieces of heavy sheet rubber



CUT FROM 6" SQUARE OF RUBBER

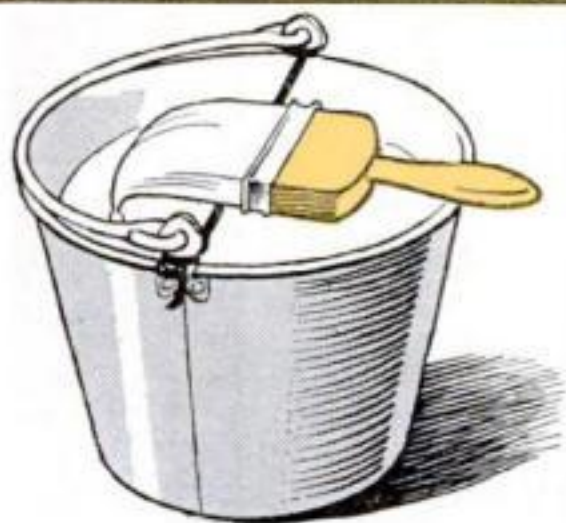


BIND WITH TAPE



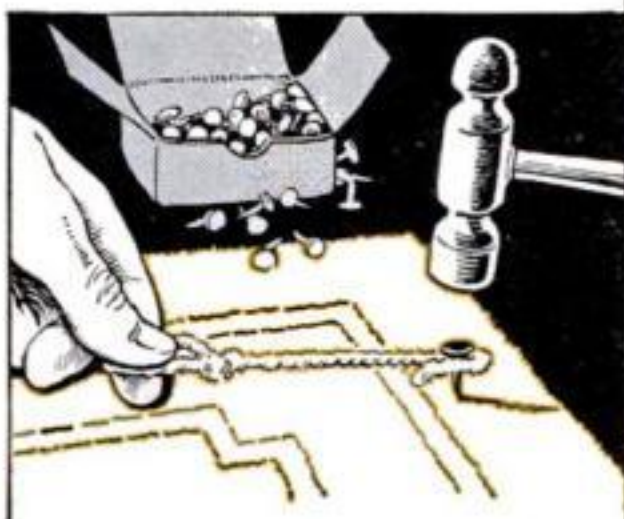
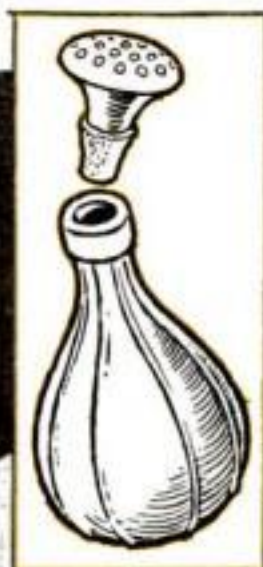
Either a rubber stair tread or a piece cut from an old inner tube may be used for the pads. They are tacked and taped on the legs

HOME



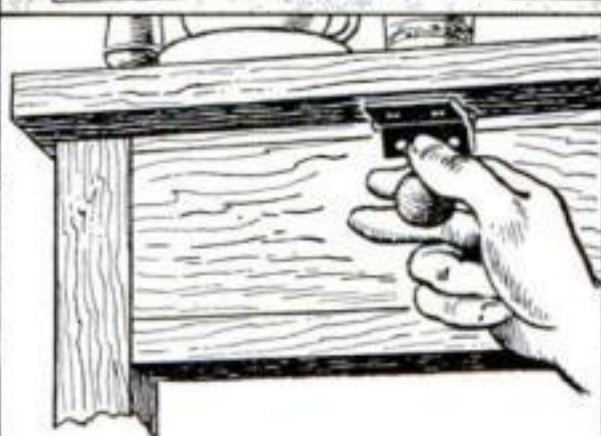
A stout cord tied to the handle lugs of a wall-paper paste pail serves as a handy rest for the brush when not in use. Excess paste may be removed from the brush by wiping it off against the cord with a little pressure

With a sprinkler made as shown below, it is easy to moisten clothes evenly and quickly for ironing. It consists of a bulb taken from a battery filler and an ordinary sprinkling head sold at most hardware and ten-cent stores

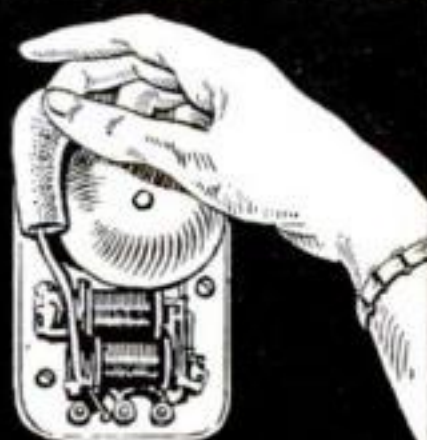


BENT PIPE CLEANER HOLDS CARPET TACKS IN PLACE

Short carpet tacks are easily started with the aid of a pipe cleaner. Slip out the cleaner after the tack is partly driven



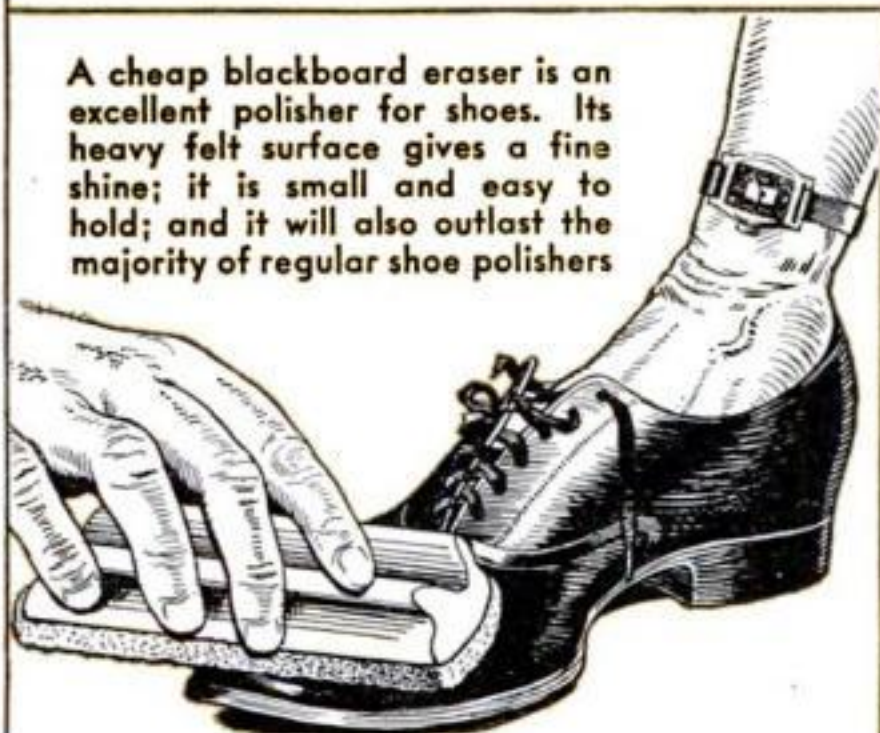
Small children may be kept from opening a cutlery drawer in a kitchen or breakfast-set table by fastening a small butt hinge upside down on the underside of the table top in front of the drawer. To open, push up the hanging hinge leaf



OLD GLOVE FINGER QUIETS DOORBELL

A finger cut from an old glove will silence a doorbell when some one is ill or when the baby is asleep

A cheap blackboard eraser is an excellent polisher for shoes. Its heavy felt surface gives a fine shine; it is small and easy to hold; and it will also outlast the majority of regular shoe polishers



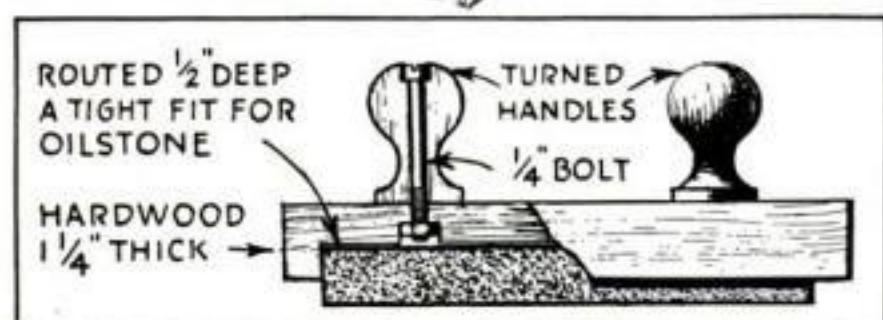
KEEPING CLOTHES HANGERS ON A LINE

If two clothes hangers are used instead of one, a dress, coat, or sweater will not blow off the line when put out for an airing on a windy day

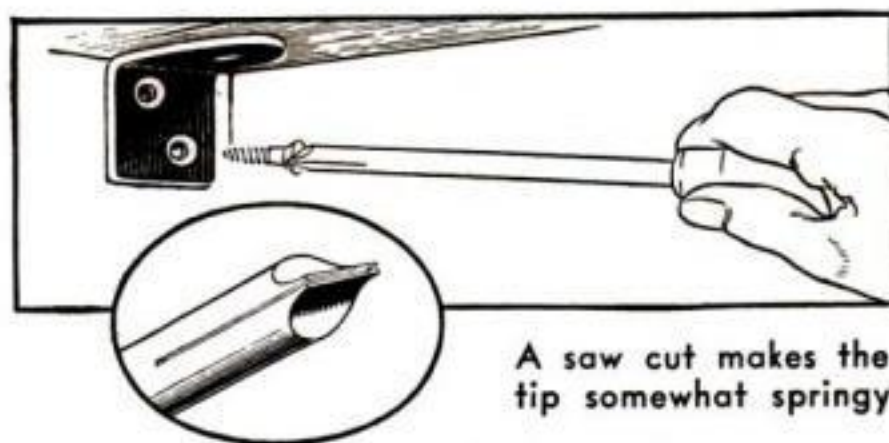
Oilstone Set in a Block for Sharpening Skates



MORE even pressure can be applied to the oilstone while sharpening ice skates if it is mounted as shown in a block of maple or other hardwood. Rout out the block so the stone will fit in tightly, and add two handles.



The block should be about 1" longer and wider than the stone. It is routed out $\frac{1}{2}$ " deep to fit



A saw cut makes the tip somewhat springy

Screws Held on Driver by Slotted Tip

A SCREW driver for holding screws to be driven in tight corners can be made from a piece of $\frac{1}{8}$ " or $\frac{3}{16}$ " drill rod. This is slotted down the center with a thin hack-saw blade deep enough to make the top edges slightly flexible. The tip is then filed or ground concave as shown. When it is inserted in the slot of a screw head, the pressure is sufficient to hold the screw securely while being driven in place.—E. WONDRAČEK.

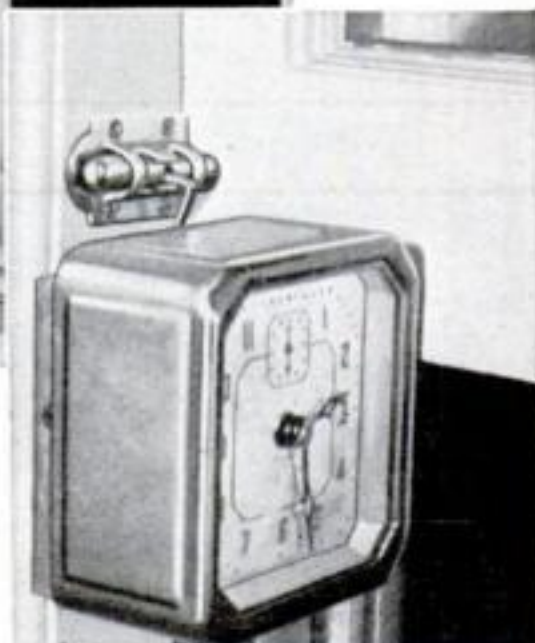
Keeping Down Dust in the Shop

SHOP floors can be quickly dampened before sweeping with a twenty-five cent spray gun of the continuous-spray type.—E. R. O.

Alarm Clock Closes Bedroom Window in the Morning



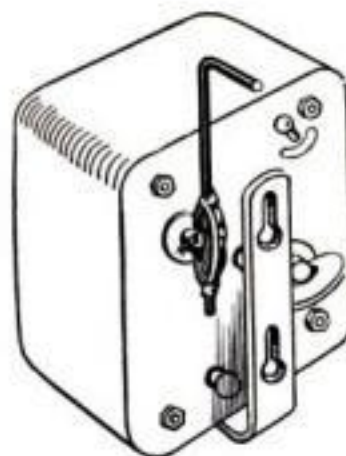
The alarm clock moves the bolt, and the weight hooked on the lower sash pulls down the window



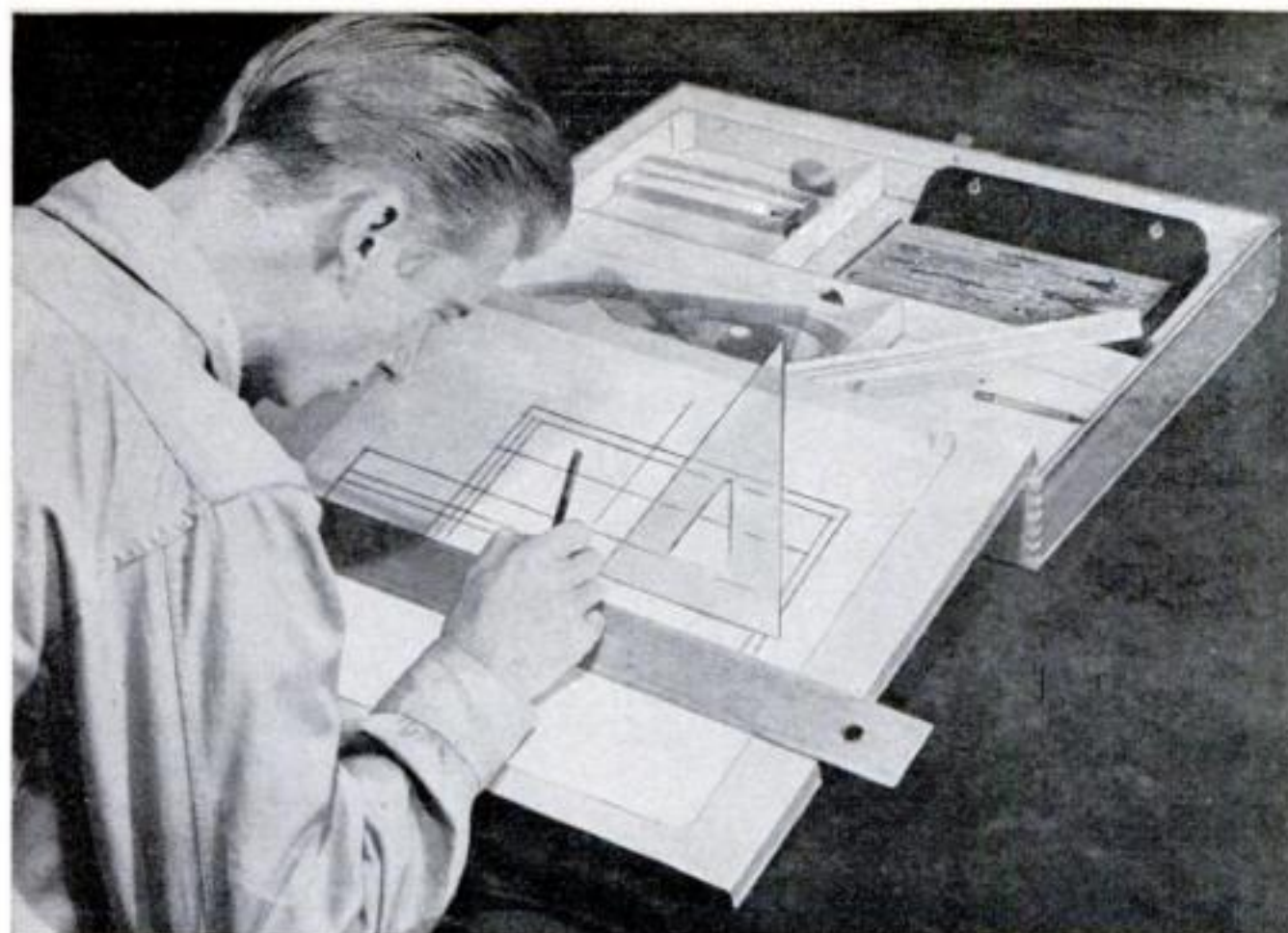
ALTHOUGH many methods of using an alarm clock to close a bedroom window in the early morning have been devised, one of the simplest is that illustrated. The window is adjusted to slide easily, and, if necessary, hot paraffin is applied to the runs. The weight is a piece of iron pipe with its lower end closed by a cap and its upper end by a wooden plug. Lead shot is poured into the pipe until it closes the window gently.

To hold the window up, an ordinary bolt is used as indicated. Beneath this an inexpensive alarm clock (with bell removed) is mounted on two screws by means of slotted holes in an L-shaped bracket soldered to the case.

It can then be readily removed for winding. A piece of stiff wire is soldered to the alarm-winding key of the clock and bent so as to engage the hole in the bolt from which the knob has been removed. When the alarm goes off, the key turns the wire and slides the bolt back so that the window will immediately close automatically.—BERTRAM BROWNOLD.



The bent end of the wire engages a hole in the bolt



When the box is open, the board rests at a convenient angle for drawing. Everything can be carried except the T-square and ink



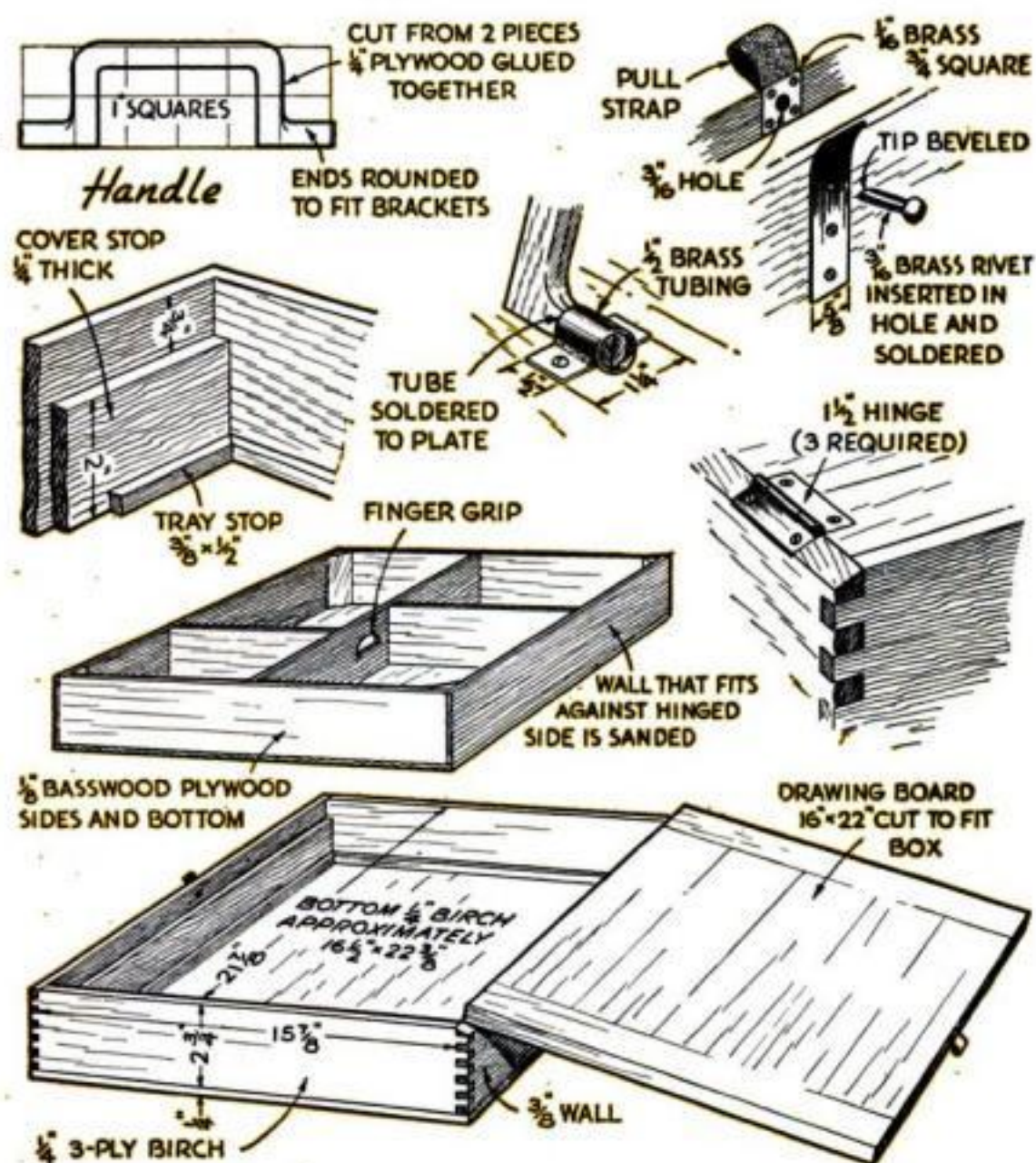
Complete Drafting Kit

CARRIED IN A PORTABLE CASE

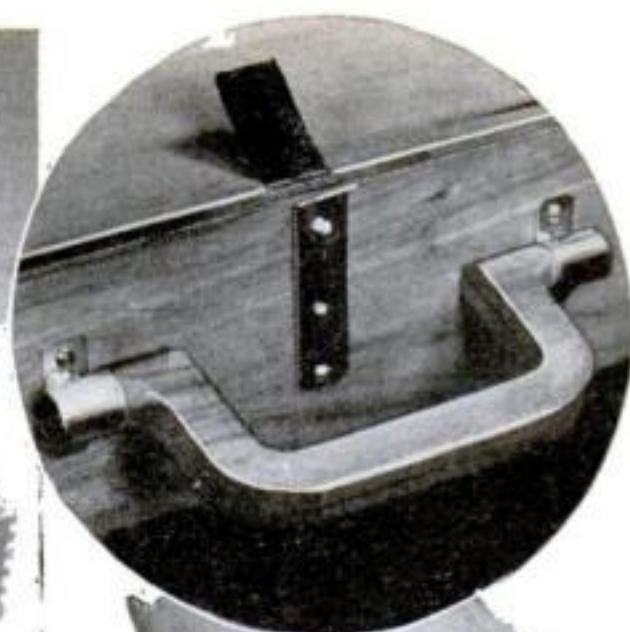
By
**HENRY and RICHARD
HANSCOM**

CRAFTSMEN who make occasional drawings, as well as architects, engineers, and draftsmen, will appreciate the many features contained in this drawing box. A removable tray affords ample room for drawing instruments, and a compartment beneath keeps a supply of paper clean and flat. When opened, the board rests at a convenient angle for drawing.

The tray should be slightly smaller than the inside of the box, and because of the thin wood it is advisable to use glue alone for fastening the walls and partitions. The latch is simply a brass rivet soldered to a strip of spring



Drawings for making the kit. Note how the three hinges are fastened and that the back edge of the box is beveled for the board



Above, paper is stored under the removable tray. At right, notched pieces aid in gluing up the corner blocks. In circle, a close-up of latch and handle

brass, and a plate sunk into the edge of the cover. A short pull strap is set into the dado, the undrilled plate is screwed in place, the cover closed, and a $\frac{3}{16}$ " hole drilled through the case wall into the plate. The hole in the case is then reamed slightly, and the spring brass plate is screwed into place. Two coats of shellac over the entire exterior, followed

by a rubbing with steel wool, will give a satin finish. No accommodations have been made for ink because of the possibility of its spilling when the case is carried.

Ski Carriers Fastened to Rear Auto Bumper

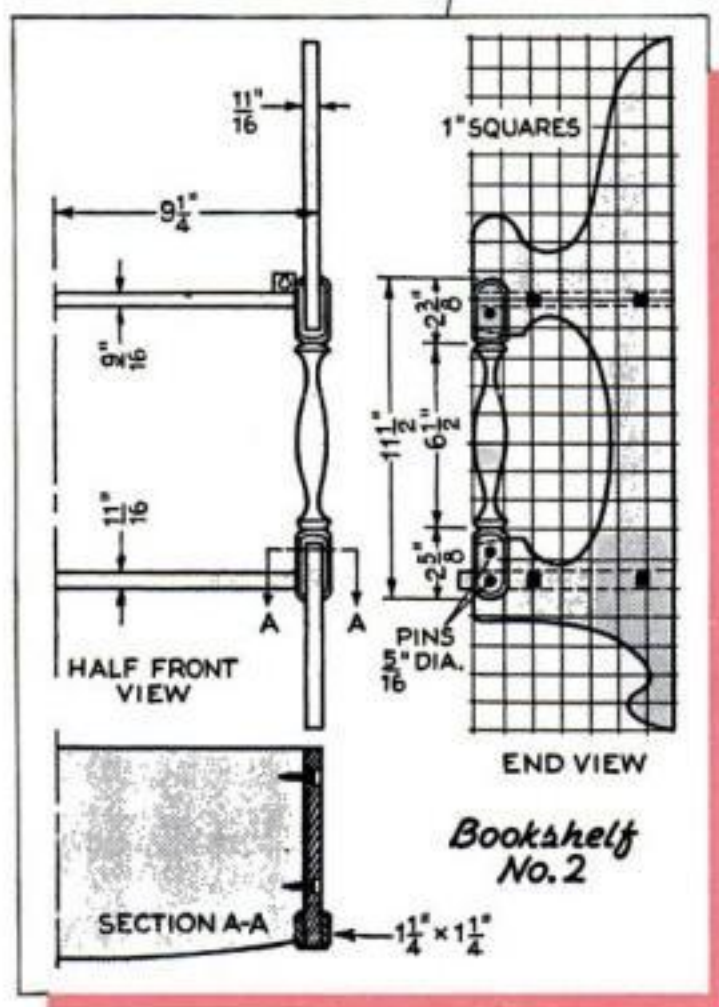


Each carrier will hold two pairs of skis and is easily removable. At right, detail of how to attach the carrier



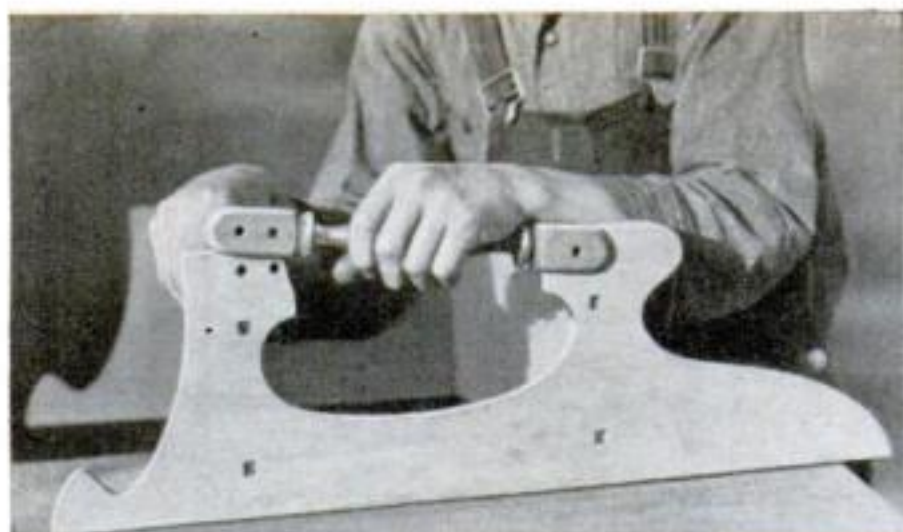
WHEN the usual type of ski rack cannot be fastened on top of an auto, as in the case of a coupe or convertible model, carriers of the type illustrated at the left may be mounted at each end of the rear bumper. Each carrier will hold two pairs of skis. The uprights are $\frac{3}{4}$ " tubing with flat crosspieces welded top and bottom. Two pieces of strap iron are welded to the tubes and fastened to the bumper supports with a single bolt. To the end of the frame is welded a length of curved bar iron, which hooks under the bumper. This hooked bar should be taped, or padded with a short piece of hose to protect the bumper from getting scratched. Two straps, one at each end of the frame, hold the skis in place. The carriers are easily removed because only one bolt needs be unfastened for each. Ski enthusiasts sometimes leave the carriers on all winter, however.—ARTHUR HOLMES.

ORNAMENTED WITH WOOD TURNINGS



Fasteners for hanging the shelves are cut and drilled from a 16-gauge (1/16") sheet steel.

By
ROGER
MOYER

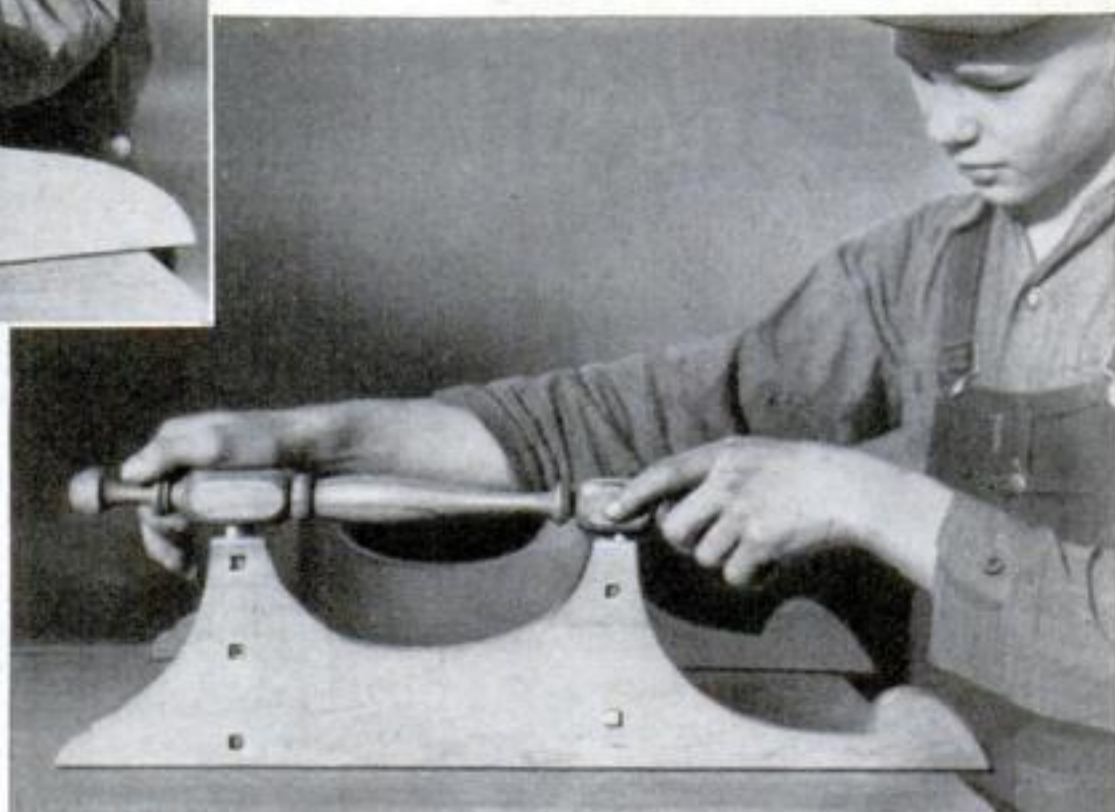


Adding the decorative turnings to two of the bookshelves. In one design, left, they are held with wooden pins; in the other, below, they are fastened with blind dowels. All parts are maple

Roundhead $1\frac{1}{2}$ " No. 10 screws are placed in the wall 16" apart to engage the hangers.

If a tone darker than the natural color of the wood is desired, it can be obtained by staining with a solution of bi-chromate of potash in the proportions of an ounce to a pint of water. This should be tried on a piece of scrap material.

An oil finish was given these pieces. A half-and-half mixture of turpentine and boiled linseed oil was applied with a cloth and rubbed down after twenty-four hours. This was followed with a light coating of linseed oil only, rubbed again after twenty-four



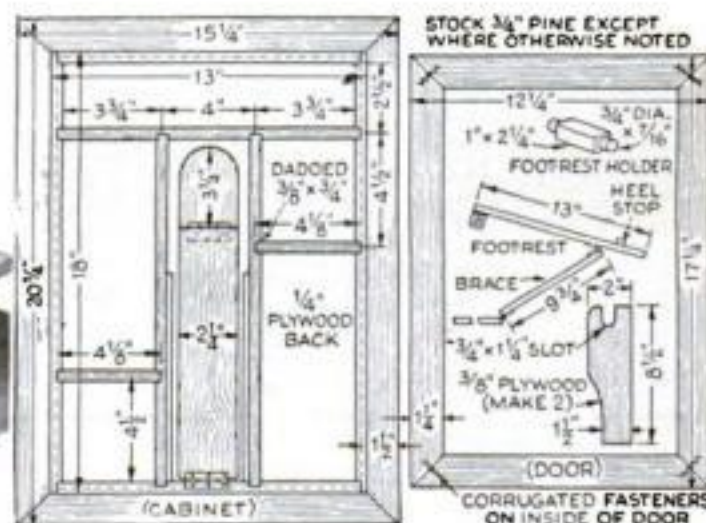
hours. Four or five coats applied in this manner result in a delightful, satiny finish without the defects that often mar a varnish finish when attempted with the limited facilities at the command of the average home worker.



Shoe-Polishing Cabinet Built into Wall to Save Space

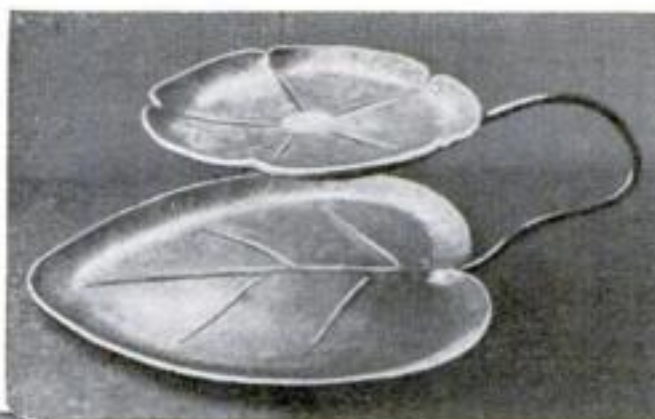
THIS built-in cabinet holds shoe polish, liquids, and brushes and has a folding footrest of convenient height. The cabinet is designed to fit between ordinary studding, 16" from center to center. The bottom of the opening in the wall should be about 10" from the floor. The supports for the foot-rest holder are nailed, with their straight edges facing out, to the two center partitions. The brace is hinged to the cabinet and footrest with 2" butt hinges. The door frame is grooved for a $\frac{1}{4}$ " plywood panel and has mitered joints held with corrugated fasteners. Hinge the door with butterfly hinges.

The cabinet is assembled as a unit, foot rest and all, and then placed in an opening cut in the wall. It is nailed to the studding from inside. Paint it to match the wood trim



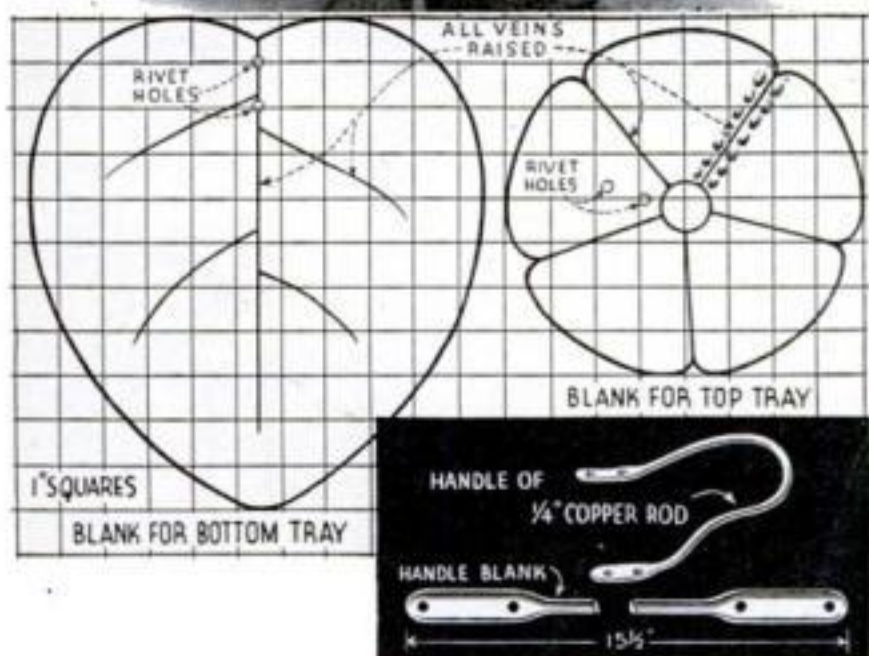
All the veins are raised by hammering down along each side

Small Leaf-and-Blossom Tray Hammered from Aluminum



ALUMINUM responds readily to the craftsman's hammer, and anyone will be surprised at how little time and effort are required to make this useful and decorative double-deck leaf-and-blossom tray.

The two trays are cut from 16-gauge soft sheet aluminum, and the hammering and shaping are done with the polished planishing end of a ball-peen hammer. Sketch pencil lines in to represent the veins. These should then be slightly raised by driving the metal down on each side of the lines, as illustrated. The handle is of $\frac{1}{4}$ " polished copper rod. It is riveted on with aluminum rivets, which should be hammered down evenly so that they will not show in the inside of the finished trays. The trays are polished with fine abrasives, but not lacquered.—DICK HUTCHINSON.



Reading Star Charts at Night

IN TEACHING stars to nature groups, we had difficulty in using the star charts at night. A flash light was unhandy, so we cast about for another solution and finally hit upon luminous paint. The star dots and letters were traced with the paint.—L. B.

INSIDE FINISH FOR DRESSER DRAWERS

[PAINTING]

1. Sand drawer sides, ends, inside bottom, and back faces glass smooth with No. 4/0 garnet paper. Dust out carefully.
2. Mix 1 part orange with 3 parts white shellac and reduce with 4 parts denatured alcohol. Pour this into an equal volume of shellac-mixing lacquer, if available. Do not make up more than needed.
3. Apply a thin, even coat with a minimum amount of brushing. Let dry hard and sand with No. 6/0 garnet finishing paper moistened on the paper back.
4. Apply a second coat. Dry hard. Resand glass smooth. Test the corners, edges, and faces with the fingers. Dust out.
5. Wring out a cotton-flannel cloth in water; apply a few drops of white mineral oil; rewring the cloth several times, and then use to wipe clean all finished surfaces.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

SHEPHERDS'

HOW TO MAKE SWEET-TONED MUSICAL INSTRUMENTS AT



Quartet of bamboo pipes. Left to right, treble pipe in the key of D, alto in A, tenor in D, and bass in G



PROBABLY the easiest and cheapest of all musical instruments to make is a bamboo shepherd's pipe. It has a soft, sweet, flutelike tone that is pleasing in solos and especially delightful in trios or quartets.

The making and playing of shepherds' pipes is a hobby of growing popularity, not only among school children and Girl Scouts, but also among adults. In England there is an active organization known as the Pipers' Guild, and the American National Branch of the Pipers' Guild was recently organized in the United States under the direction of

Top and side views of a treble pipe, showing the spacing of the holes, and a chart of the fingering

PIPES

A COST OF A FEW CENTS

Miss Jennie Cossitt, musical director of the Union Settlement, New York City. Simple songs and folk dances, especially those written in the keys of G, D, and A, are readily played on the pipes either from printed music or by ear, and a variety of specially arranged music for pipes is available.*

Although pipes are made in various sizes, the first one to construct is that known as the treble pipe. This requires a piece of bamboo from $\frac{3}{4}$ " to $\frac{7}{8}$ " in inside diameter and about $11\frac{1}{2}$ " long. Unless a long enough piece of bamboo can be obtained without a joint, it will be necessary to file, bore, or burn out the partition at the joint or joints. In other words, there must be a smooth, uniform hole all the way through.

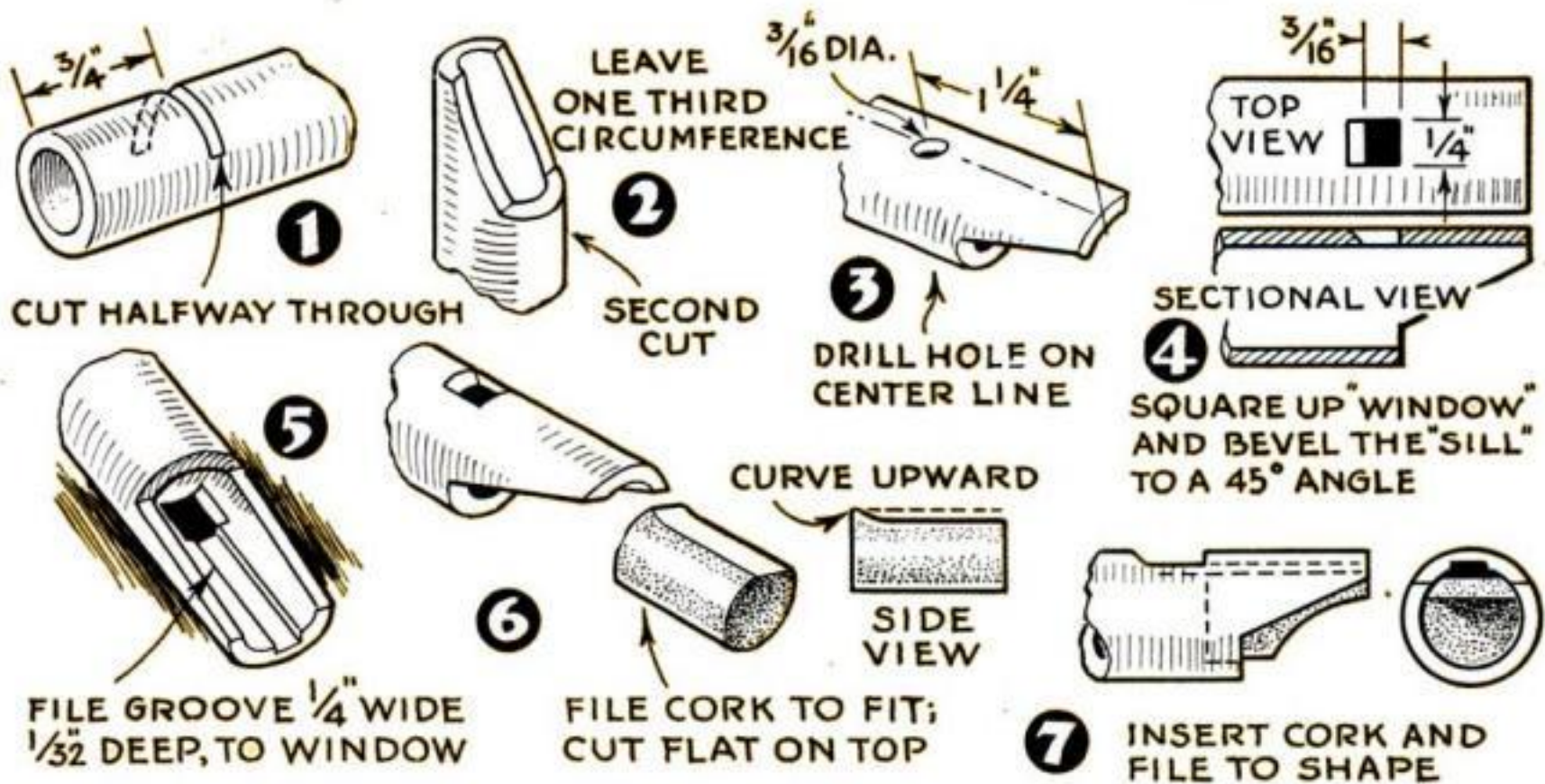
The mouthpiece can be at either end, but should be at

*See *How to Make and Play a Shepherd Pipe* by Augustus D. Zanzig, price 35c, National Recreation Association, 315 Fourth Avenue, New York City.



The first step in making the mouthpiece is to cut down halfway with a fine saw

The bamboo for treble, alto, and tenor pipes. Corks to fit are also required



Obtaining a good tone depends to a large extent upon the way the mouthpiece is made. The beveled edge of the window must be very sharp. If the tone is faint, file the cork to increase the air passage

least 2" from the nearest joint. Locate it so that the groove in the bamboo, if there is one, will be along the left or the right side rather than on top where it would interfere later with closing the holes. Cut the mouthpiece as shown with a hack saw or other fine-toothed saw.

In the center of the top, $1\frac{1}{4}$ " from the mouthpiece end, drill a $\frac{3}{16}$ " hole. Then enlarge it with the point of a sharp penknife to a rectangle exactly $\frac{3}{16}$ " by $\frac{1}{4}$ ", as indicated. Next, bevel what is called the "window sill" to a 45-deg. angle. See that the lower edge is sharp and smooth.

From the end of the mouthpiece to the window, file a shallow groove in the underside of the top to form the roof of the wind passage. This groove must be perfectly flat and square cut, but not more than $\frac{1}{32}$ " deep. Later on it can be deepened slightly if the tone does not come freely enough.

A smooth, firm cork is now fitted into the mouthpiece to reach up to the edge of the window. When it fits perfectly and rather tightly, a thin, narrow shaving is cut off it with a very



The scale must be tuned accurately by ear or with a piano

sharp knife, as shown. This forms the floor of the wind passage. Note that it is slightly curved so as to deflect the breath upward. The shape and size of this cut and the sharpness of the edge of the cork are most important, but if a cork is spoiled or does not give the desired results, a new one is easily made. File the cork so that it fits comfortably in the mouth.

You should now be able to get two clear, pleasant notes by blowing gently into the pipe, one being about an octave higher than the other. Concentrate on the low note until you get a tone of satisfactory quality. Then, if you wish to play with other instruments, compare it with D on the piano—

the D which is eight notes above middle C. If the pipe seems to be a half note too low, saw off about $\frac{1}{2}$ " from the lower end; if it is a whole note low, saw off about 1". Work slowly and saw off a little at a time until the D has been accurately tuned.

Measure the distance from the center of the window to the end of the pipe and drill a $\frac{1}{8}$ " hole at exactly a quarter of this distance from the lower end. This hole should give the second tone of the scale, or E, but it will probably be too flat, so enlarge it by small degrees with a reamer or sharp knife until it is in tune with E. Be careful not to split the bamboo.



At right, the cork, after being properly fitted, is filed down underneath until the mouthpiece fits comfortably between the lips. In circle, how toothpicks are used for raising the pitch

The second hole is placed about $\frac{7}{8}$ " above the first one unless the first hole had to be made larger than $\frac{3}{16}$ ", in which case it is better to space it 1" away. It should be tuned to F sharp. The third hole, placed about $\frac{7}{8}$ " away, is tuned to G.

By closing these three holes with the first, second, and third fingers of the right hand, you will be able to sound the original D. Then, by raising the fingers one after the other, the notes of the scale will sound up to G.

Place the remaining three holes approximately as shown, and tune them to A, B, and C sharp. The latter is usually placed $2\frac{1}{4}$ " from the window. The final hole, which gives D an octave above the first tone, is drilled on the other side or bottom of the pipe a trifle above the position of the sixth hole, and it is closed with the left-hand thumb.

If any holes are enlarged too much by mistake, they can be reduced in size with plastic composition wood, which may also be used for filling any cracks.

Three small additional tuning holes can be drilled where indicated, if desired, for raising the pitch of the entire scale, and these are plugged with small tuning pegs. A rubber band stretched over the top part of the window will lower the pitch a trifle.

Half tones are obtained either by uncovering about half the hole instead of all of it, or by closing one or two holes immediately below the open one which gives the note it is desired to flatten. Each pipe has an individuality of its own, so the fingering for the half steps in the scale has to be worked out by experimenting.

The alto pipe is tuned to A and requires a piece of bamboo at least $\frac{7}{8}$ " in inside diameter and $16\frac{1}{2}$ " long. The window is cut $\frac{1}{4}$ " by $\frac{5}{16}$ ". The tenor pipe is tuned to D an octave below the treble pipe. It requires a piece of bamboo about $1\frac{1}{4}$ " in inside diameter and 24" long, and the window is cut $\frac{3}{8}$ " by $\frac{5}{16}$ ". In this case, the first hole is placed almost $\frac{1}{4}$ " farther up the pipe than the quarter mark. Bass pipes are made both from bamboo and aluminum tubing, and are tuned to the key of G. They require a piece of $1\frac{3}{8}$ " or $1\frac{1}{2}$ " in inside diameter and 36" long. The window is placed $1\frac{3}{4}$ " from the mouthpiece end and is $\frac{3}{8}$ " by $\frac{1}{2}$ ". The first hole in this case is one third instead of one fourth the distance from the middle of the window to the end; and the sixth hole should be about $10\frac{1}{4}$ " from the middle of the window.

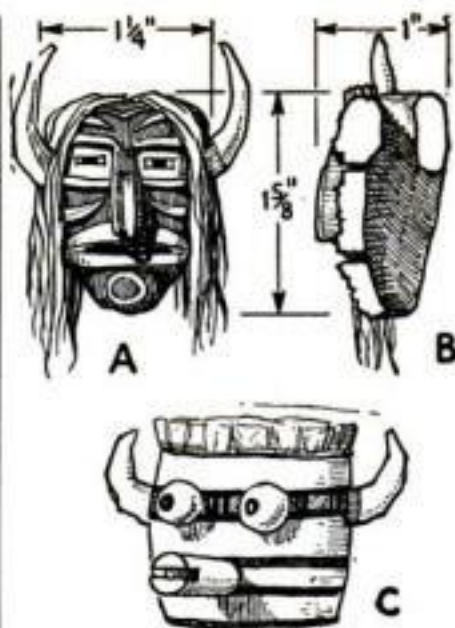


Miniature Electromagnet Loads Model Train

A SMALL electromagnet for loading freight on a model train may be made from materials which nearly every experimenter has lying around.

The core is a shingle nail with the point cut off. A small washer, made from a disk of sheet metal the same size as the nailhead, is soldered on the nail 1" from the head. A loop of wire is also soldered to the end of the nail for attaching the magnet to the cable of a crane. Fill the part between the washer and the head by winding on even layers of any available small magnet wire, such as No. 34 enameled. Leave the ends of the wire long and cover the coil itself with a layer of cellulose tape.

One dry cell, which may be concealed under the freight platform, will operate the magnet. If suitable lightweight "freight" made of steel is not available, imitations can be made of balsa wood or pine and painted, but drive in a tack or small nail at the balancing point so that each piece can be picked up by the magnet.—FRED KUHLMANN, JR.



Indian Finger Masks Made into Neckerchief Slides

BOY SCOUTS who wish to make something unusual in the form of neckerchief slides can do so by whittling them in the form of Indian finger masks from soft wood. These were symbols of secret societies or professions and were worn on the fingers during ceremonial dances. The design shown at A and B is a Sioux mask with the skin colored red and the lips, eyes, and hair white. At C is a Zuni mask with white skin and black trimming. The squares in the eye band are painted red, green, and yellow. The head-dress is tinted light yellow or blue. Dog hair or frayed cord will serve as hair, if it is needed.—GEORGE C. SPONSLER.



Chair Tip Acts as Hook Latch

ON SMALL chain hooks, which have no latch to keep the links from dropping out, a common crutch or chair tip will serve to keep them in place securely, as illustrated at the left. The tips may be obtained in several sizes to fit different hooks.

Removing Colored Printing

TO REMOVE colored printing and designs from celluloid or plastic objects, such as advertising novelties, rub them with a cloth moistened with acetone or nail-polish remover, which is obtainable at drug stores. Then clean the surface with another cloth and a little alcohol.—M. H. KINDERMANN.

Pencil Holds Materials for Emergency Mending

A NEEDLE and several lengths of thread in popular shades can be kept in a mechanical pencil of the type shown at right for emergency mending when away from home facilities. The threads are braided together and folded as compactly as possible. Easily carried in a pocketbook or clipped to a pocket, one may write or mend as required.



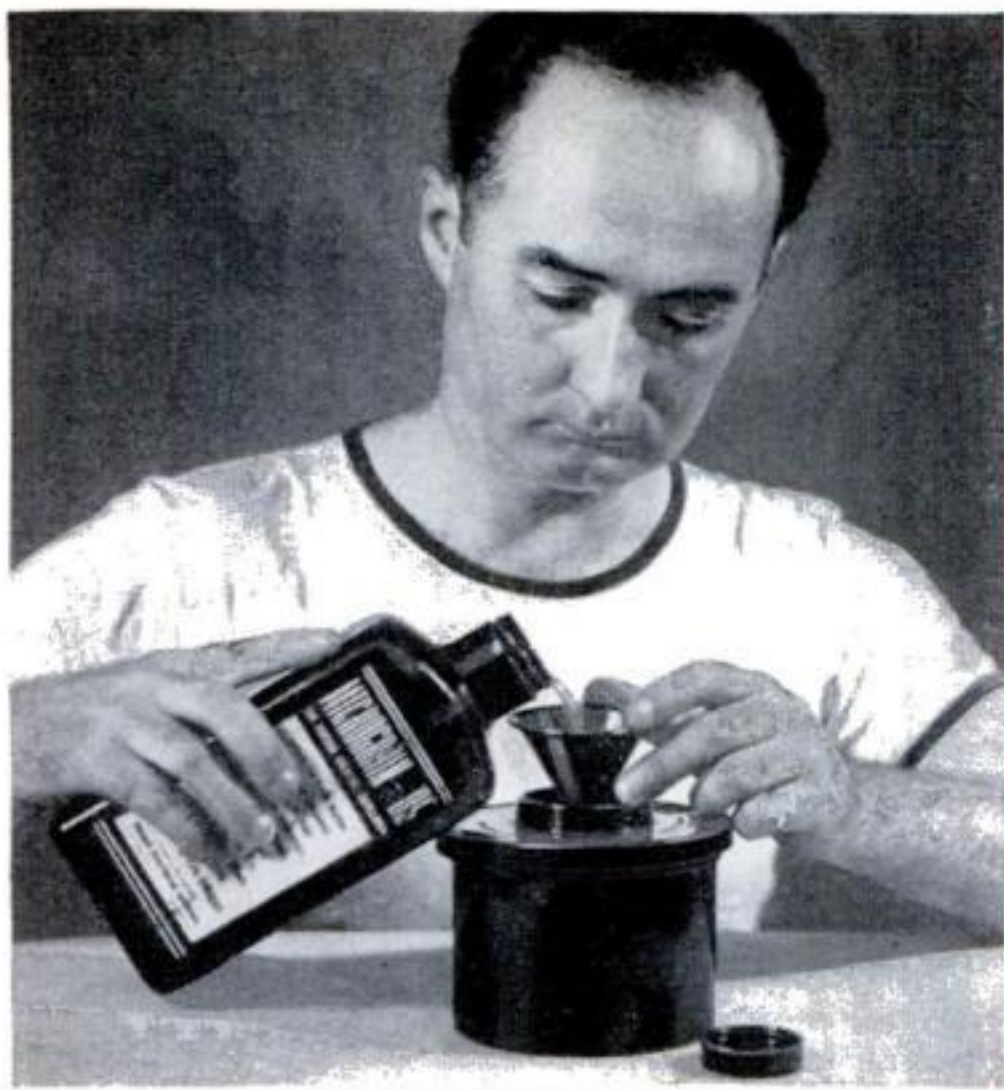
A needle and several lengths of thread are carried in the pencil



Electric Iron Kept Handy in Extra Deep Closet

WHEN space permits, it is best to make an ironing-board closet slightly deeper than usual, as illustrated. The iron can then be left on its shelf at all times and does not have to be put away separately. Sheet asbestos should be tacked to the closet walls around the iron shelf to protect them from being scorched. A band of the same material is wrapped around the ironing board near the hinged end to safeguard it when the closet is closed.—J. MODROCH.

Tricks IN USING ROLL-FILM Tanks



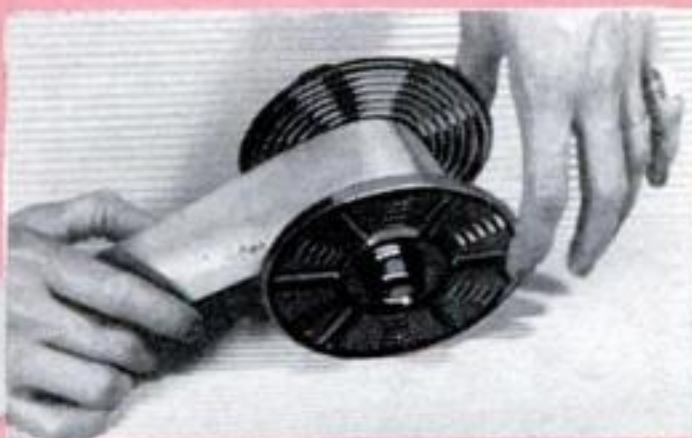
A tank should be filled with developer as quickly as possible. To help in doing this, sand the outside of a small plastic funnel to fit the opening tightly



After washing film, place one drop of potassium-permanganate solution inside the core, then let wash water flow through slowly. A purple color shows that all hypo has been removed



When cut films are developed in a roll-film tank, line up six on each side, their ends side by side. This will prevent developing marks made by the end of one touching another



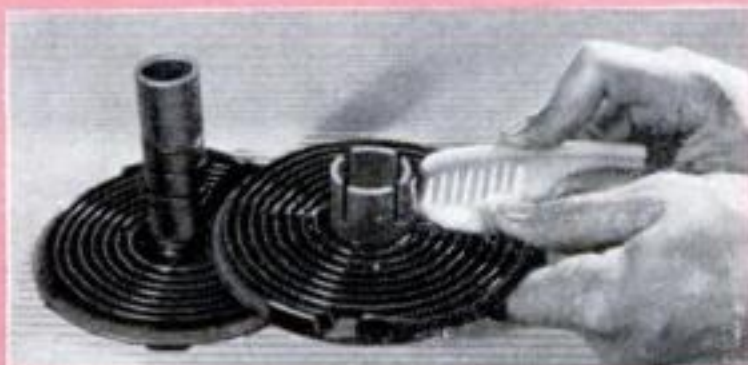
If a roll refuses to feed into the reel without sticking, try starting it at the core. Squeeze the edges bow-shaped so they will fall into and follow the grooves



Above, finger-nail clip-pers are used to round the corners of a film so it will slide in easily. Left, a comb with every other tooth removed is used with a wad of cotton to dry reel grooves



For odd sizes or if the adjustment has become worn, wind a clean rubber band tightly around the core to hold the parts



File-Card System

FOR KEEPING A RECORD OF YOUR PHOTOGRAPHS



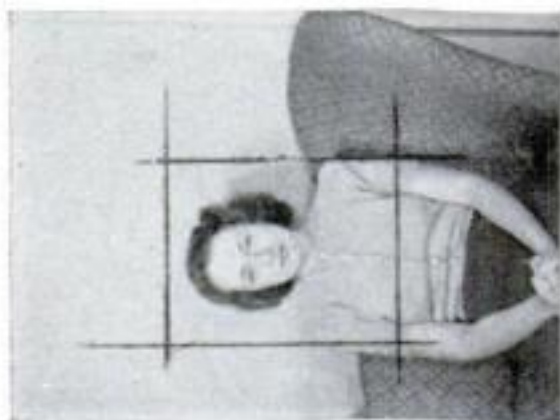
THE problem of recording exposure data systematically has troubled the amateur photographer for years. Memory cannot be trusted, and data scribbled on scraps of paper are often lost before being permanently written in a log book. The logs themselves are often inadequate and seldom contain sufficient space for all the information that should be preserved.

To solve these difficulties, the accompanying data card was especially prepared for POPULAR SCIENCE MONTHLY readers.

It is based upon a suggestion made by Theodore Blank, an amateur photographer of Dorchester, Mass. If printed on 3" by 5" cards, these forms are easily filed and an adequate supply of blank cards can always be carried in the pocket. Any amateur may have a local printer copy the set-up and print a supply for his own use, or they can be reproduced by the inexpensive photo-offset process. It should be noted, however, that the cards are copyrighted and are not to be sold commercially.

In using the cards, the best procedure is to jot down all the exposure data at the time the picture is taken and then fill in the rest of the card later when darkroom tests reveal which grades of contact and enlarging paper give the best

SUBJECT <i>Ann Smith</i>	LOCATION <i>Living Room</i>	TYPE OF FILM <i>Veri-chrome</i>	APERTURE <i>f. 16</i>	SHUTTER SPEED <i>1/2 sec</i>	NEG. FILE NO. <i>A-221</i>
DATE <i>10/16/39</i>	TIME OF DAY <i>8:30 P</i>	LIGHT CONDITIONS <i>Light Walls</i>	EXPOSURE <i>cc</i>	PHOTOLOG RULER NO. USED DIAGRAM	SIZE
GRADE OF CONTACT PAPER <i>No. 2</i>					



When this portrait of Ann Smith was taken, the data relating to the film, stop, speed, and lights were entered in the proper spaces on the 3" by 5" card. Later, the printing and enlarging data were added, and a print was stuck on the back for reference

results. Details regarding masking, dodging, and other manipulations can be noted under "Remarks." Mount a contact print on the back of the card and, if necessary, rule it to show which portion makes a well-composed picture. Place each negative in a separate envelope, give it a number, and file numerically; write the same number under "Neg. File No." on the data card.

A concrete example of the use of the cards is given in the accompanying photographs. The portrait of the young woman was taken in a light-walled living room. In addition to the two lights shown, there were two lights at the left side of the sitter. The position of all four was indicated in a diagram, and notes were added to show that the film was Verichrome, the stop f/16, and the speed 1½ sec.

Later, when the prints were made, the grade of contact paper, No. 2, and the exposure time, 5 sec., were entered. After the final enlargement had been made, the grade of enlargement paper, which was normal, and the exposure, 16 sec., were marked down. A contact print was then mounted on the back of the card, and lines were ruled on it to show the best composition or "cropping."

When a satisfactory enlargement had been made, lines were drawn on the reference print to show the best composition or "cropping"

Many a photographer will not use all the divisions, but they are there in case he wants them at any time. No elaborate description is required under "Subject" because the print is on the other side, available for immediate inspection. The cards may be filed alphabetically according to subject or by any other convenient method.

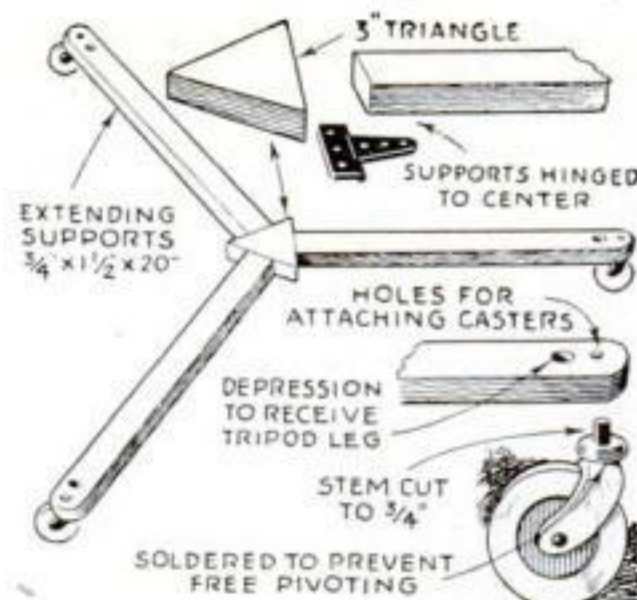
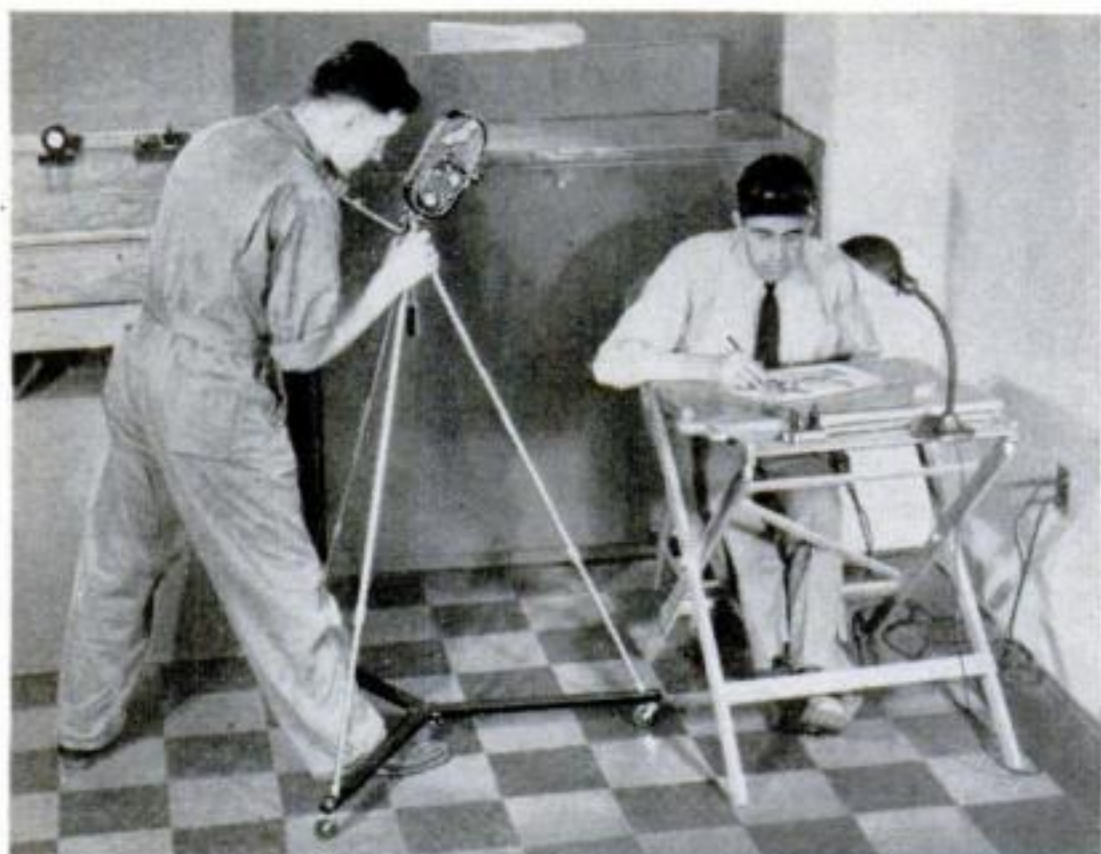
The cards are especially helpful to the beginner because they afford an opportunity for him to compare his shots and discover how to obtain the best results. The mere fact that he has to fill out the card each time will also make him conscious of factors he might normally forget.



SUBJECT		LOCATION		TYPE OF FILM	FILM SPEED	NEG. FILE NO.
					SPEED	
DATE	TIME OF DAY	LIGHT CONDITIONS		STOP	FILTER	
					PHOTOFLOOD BULBS	
GRADE OF CONTACT PAPER	EXPOSURE	GRADE OF ENLARGING PAPER	EXPOSURE	NO. USED		SIZE
				DIAGRAM		
REMARKS						

COPYRIGHT 1939 BY POPULAR SCIENCE PUB. CO., INC.

Movie Camera Wheeled About on a Folding Dolly



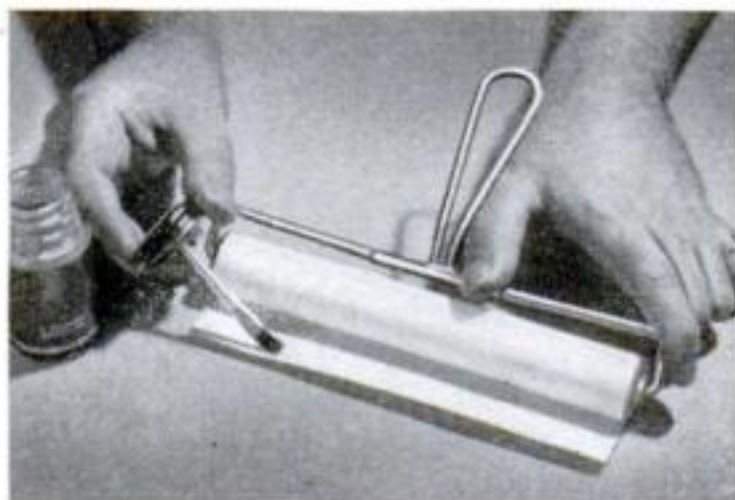
PROFESSIONAL effects can be obtained by the amateur movie cameraman if he has a homemade camera dolly or portable stand. He can then change from a general scene to a close-up without a break, or follow a moving person or object. The dolly illustrated may be folded for convenient carrying. The rolling casters should have a wheel of about 2" in diameter, with the pivoting base soldered in place to prevent free turning. The surface upon which

the dolly is rolled should be smooth, but small irregularities in the floor may be overcome to a certain extent by cementing 1/4" thick strips of sponge rubber to the caster wheels.—M. G. WINTERTON.



Ferrotypes Roller Covered with Blotting Paper

WHEN only a few glossy prints are made at a time, cover the print roller with one or two thicknesses of blotting paper. It will then press the photographs into good contact with the ferrotypes tin and remove excess water.



How to Focus Sharply When Light Is Dim

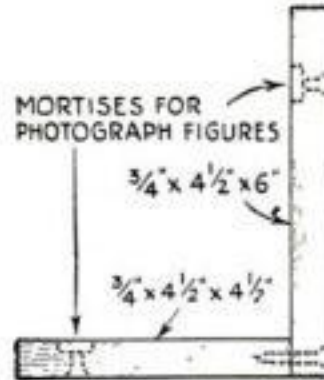
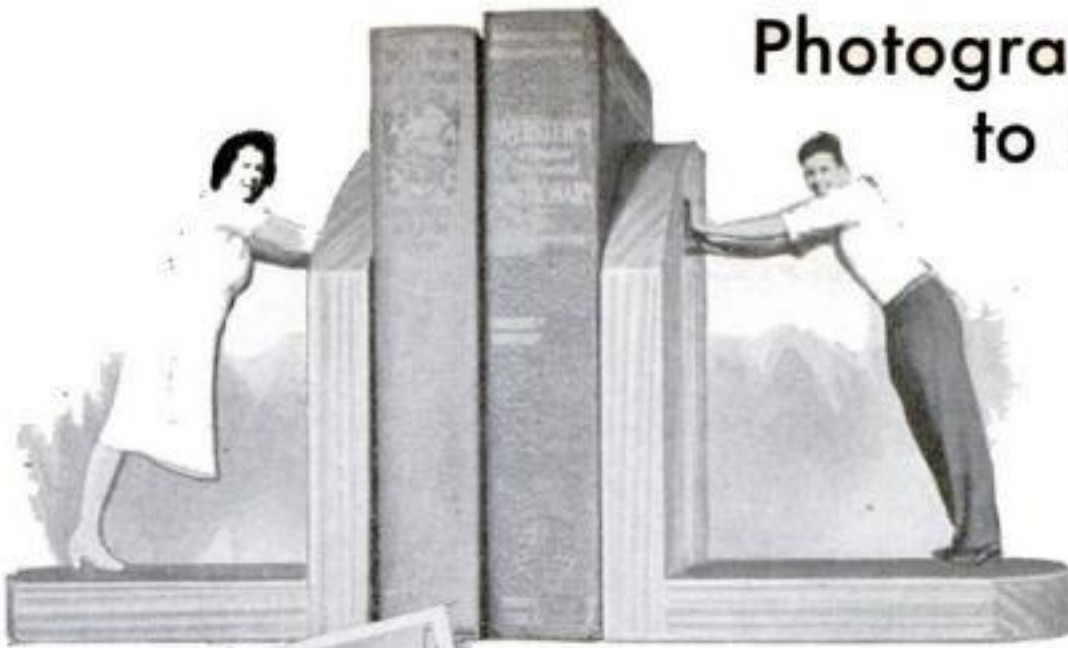
IN POORLY lighted interiors it is hard to get a sharp image on the ground glass. This can be made easier by attaching a small square of transparent cellulose tape to the middle of the glass, on the ground side. The glass becomes transparent at this point, and the clear image thus provided may be used in checking the focus.—K. L. R.

Photographic Cut-Outs Appear to Prop Up Book Ends

TO MAKE novel photographic book ends of the type illustrated, first take pictures of the subjects pushing against a wall or the side of a car and enlarge to 5" by 7". These enlargements are mounted on $\frac{1}{4}$ " thick plywood with glue or dry mounting tissue.

The outlines are then cut on a jig saw with a rather fine blade. Small extensions or tenons are left

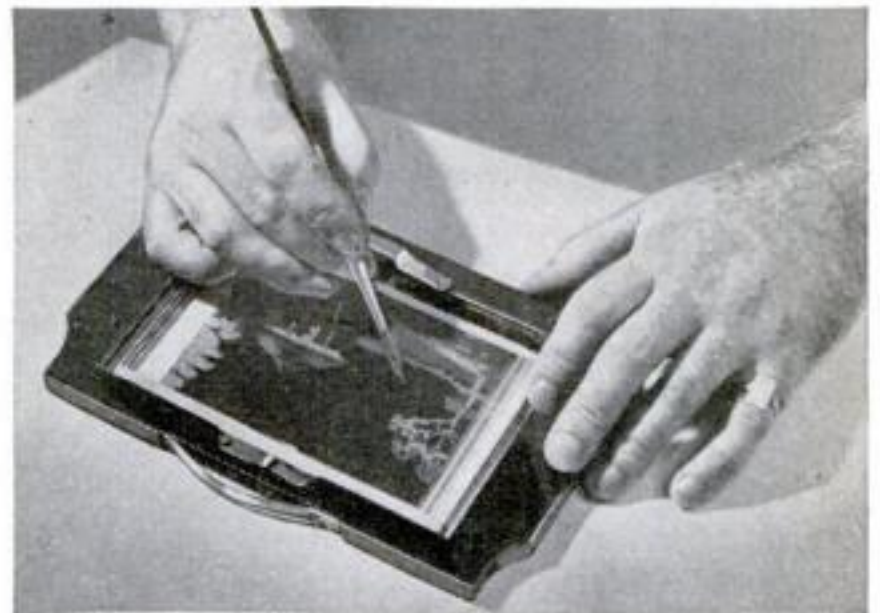
on the hands and feet for attaching the figures to the book ends, which should be of a simple design. A sharp $\frac{1}{4}$ " chisel is used to make small mortises in the centers of the bases and uprights of the book ends. The extensions on the feet and hands of the cut-outs are fitted into the mortises and fastened with glue. For further strength, small flathead screws can be inserted through the book ends into the plywood extensions. The wood may be finished with two coats of clear varnish, but apply only one coat on the photographs. Any simple design may be used for the book ends.—C. C. COOLEY.



The persons are posed pushing against a wall or the back of an automobile

Blocking Out a Negative for Temporary Use

WHEN parts of a negative are to be blocked out temporarily, the opaque may be painted on the glass of either the printing frame or the negative holder as illustrated at the right. This saves the difficulty of washing the opaque from the negative; it can be wiped from the glass in an instant with a damp cloth when the printing is completed.—CLIFFORD LEESTMA.



With this method the opaque can be wiped from the glass easily, and the negative is not touched



Pockets in Focusing Cloth Hold Camera Accessories

PHOTOGRAPHERS who use view cameras and do much of their work outdoors will find that a pocket sewed on either side of the focusing cloth will be convenient for temporarily placing film holders and other small accessories where they can be easily reached when needed. To maintain a balance, the weights in the pockets should be about equal.—C. E. HENDRICKSON.

Detachable Sling Strap Helps in Handling Large Camera

EVERY photographer who works with a bulky camera will find it advantageous to use a detachable sling strap. The one illustrated is heavy sole leather, 1" wide and 48" long, with a buckle adjustment for shortening it to 26" and with French dog-leash snaps at each end. For use with cameras of the type shown and certain other equipment, it is necessary to provide ring plates for attaching the snaps. A strap can be made to order at any leather shop.—J. H.



The strap safeguards the camera and allows free use of both hands when the photographer has to climb up to make a picture. It may be used as a safety belt



Lens Cap Attached to Camera by Means of Rubber Band

IT IS not necessary to search through various pockets of your clothes for the lens cap after using your camera if you attach it directly to the camera with a rubber band, as illustrated at the left. The cap will hang out of the way when not wanted, yet it is always ready to be immediately replaced over the lens when you have completed taking pictures.—OLIVER BANDELIER.

LIGHTING FOR COPY WORK

The light must be flat and as even as possible. Because the eye can evaluate shadow density more easily than light intensity, it pays to hold a card as shown in the center of the location to be occupied by the print. Compare the shadows and arrange the lights till they balance.

Glossy surfaces. Place lights to avoid any surface reflection to the camera. At times it is necessary to mask the entire camera (excepting the lens) to prevent its reflection.

Rough surfaces. If well-diffused lighting fails to remove difficulties, the print is often photographed while being held flat under water.

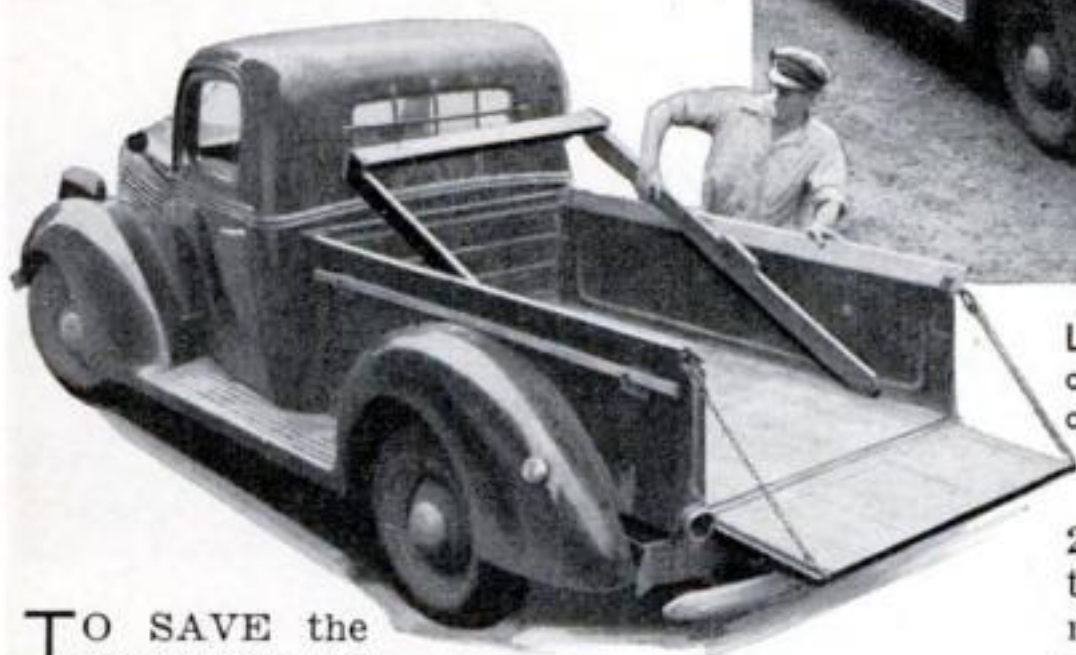
Torn, crumpled prints. Ferrotypes the face to glass and photograph through the glass. (Any cracks or surface markings not obliterated by this treatment must be retouched on the negative and following print.)

[PHOTOGRAPHY]

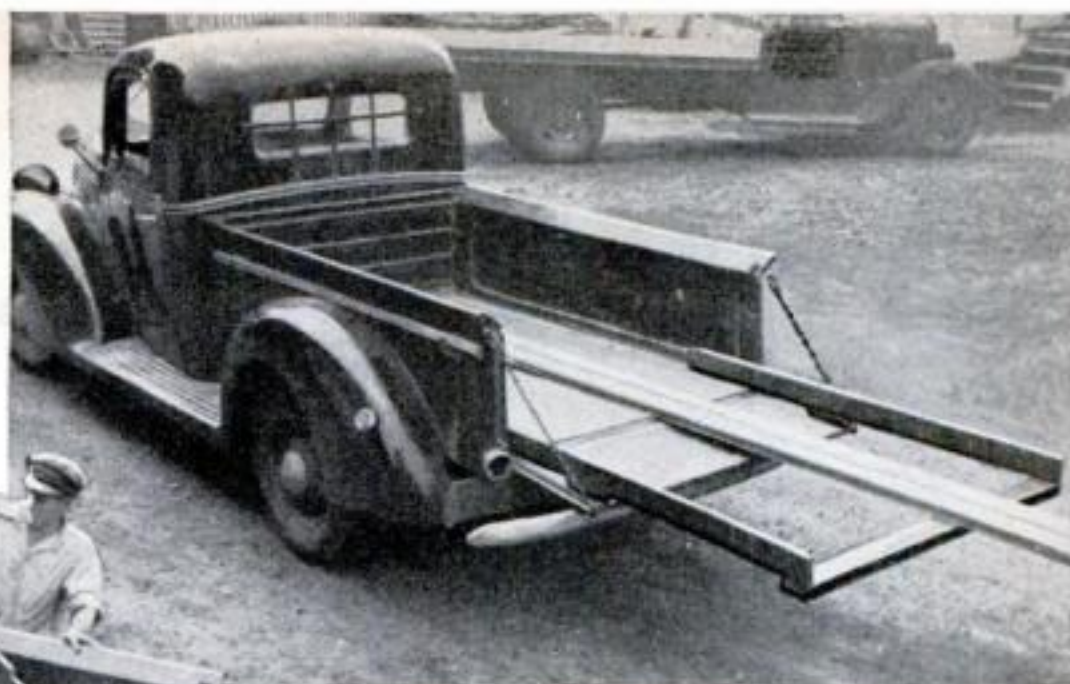


POPULAR SCIENCE MONTHLY SHOP DATA FILE

Folding Lumber Rack FOR A SMALL TRUCK

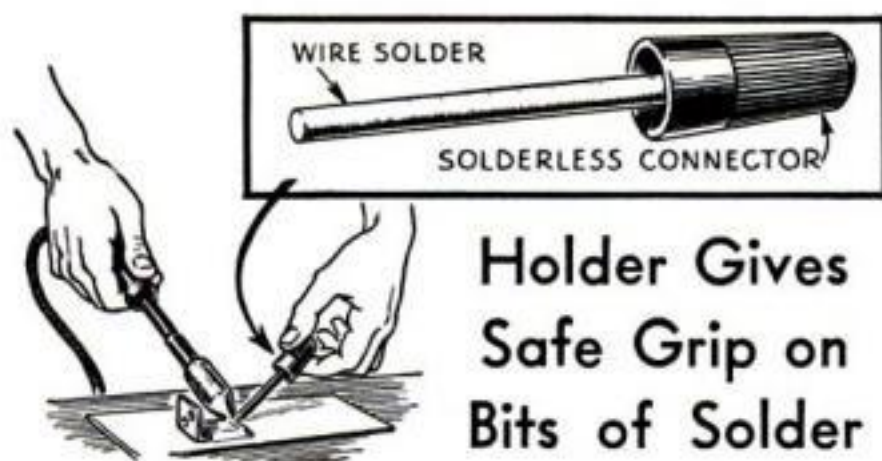


TO SAVE the expense and trouble of using a large truck to deliver small orders of long pieces of lumber, a lumberyard fitted a folding rack on its pick-up delivery truck as illustrated above. Made of



Long pieces of lumber are easily carried on the rack, which folds up on the floor of the truck when not in use, as at left

2" by 4" material, the rack is bolted to the sides of the box body so that it rests extended on the open end-gate when in use and folds back on the floor compactly when not needed. In this way pieces 16' long, or even longer if the front of the load is weighted, may easily be carried.—EMIL PEARSON.



Holder Gives Safe Grip on Bits of Solder

BY SCREWING a so-called "solderless connector" of the type commonly used in electrical work on the end of a short piece of wire solder, as shown above, you can hold the solder without incurring the danger of burning your fingers.—V. H. BARRINGTON.

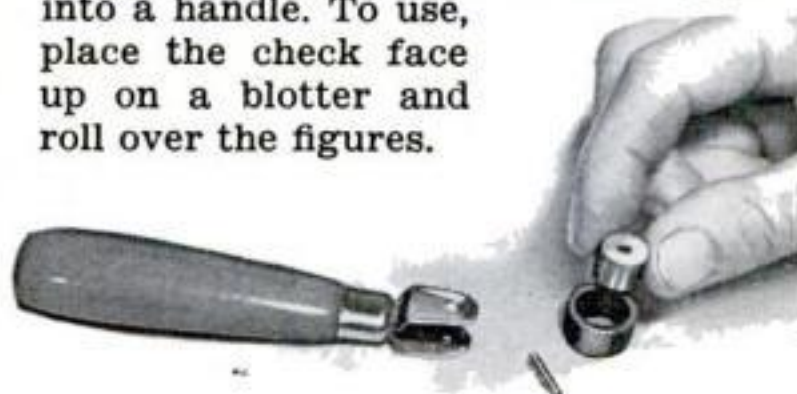
Rubber Band Protects Pull-Chain Socket

HERE is a simple means of protecting a pull-chain socket from being broken by an unusually hard pull on the string attached to the chain. I added a heavy rubber band or two between the chain and the string and they absorb sudden shocks. This idea can also be used for insulating a chain in damp places.—KENNETH GRAY.



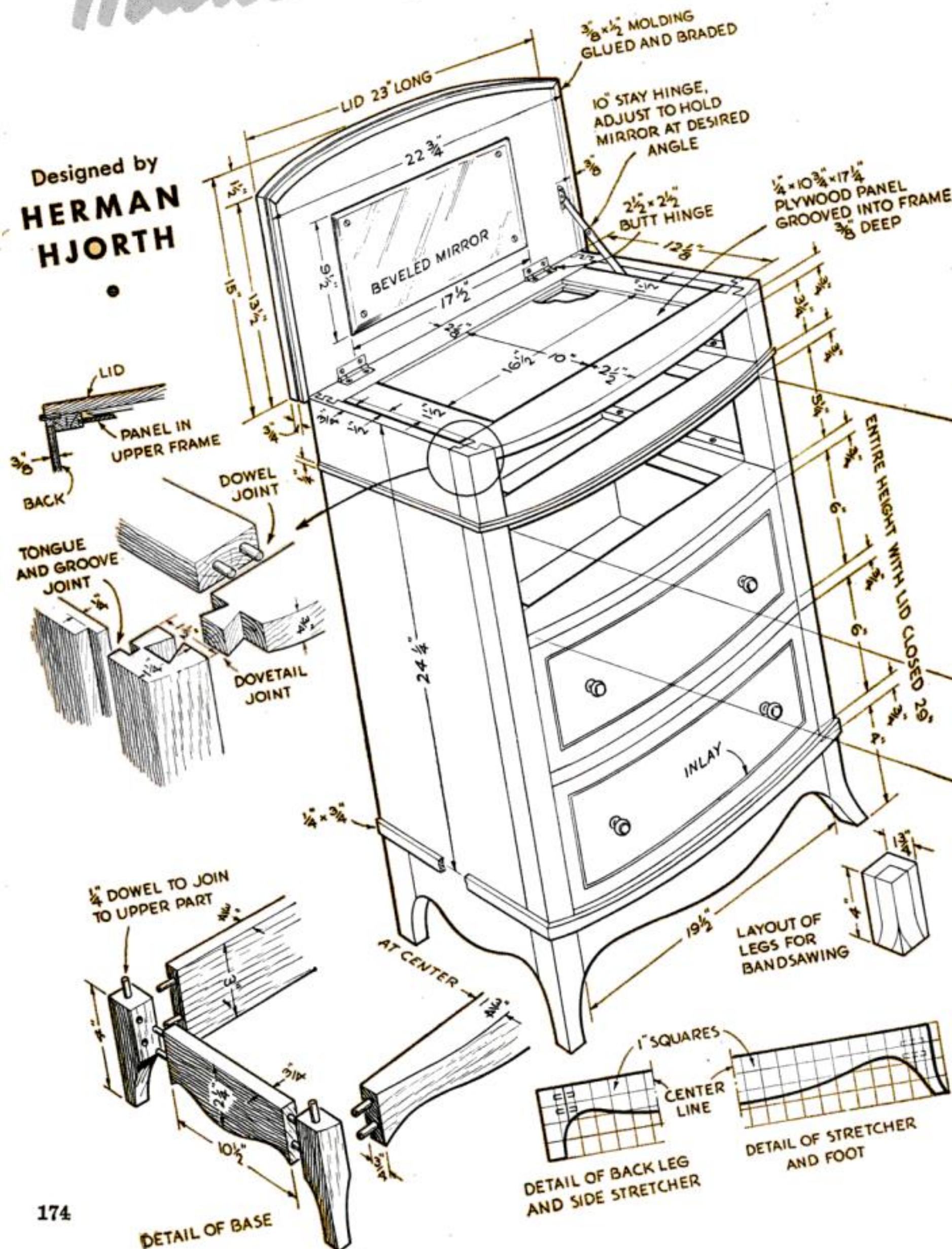
Knurled-Nut Roller Safeguards Check

AS A GUARD against checks being raised, a protector can be made from a sharply knurled adjustment nut. A piece of rod is chosen to fit inside the nut and form the bearing, and the nut is mounted between two pieces of sheet metal, bent as shown and slipped into a handle. To use, place the check face up on a blotter and roll over the figures.



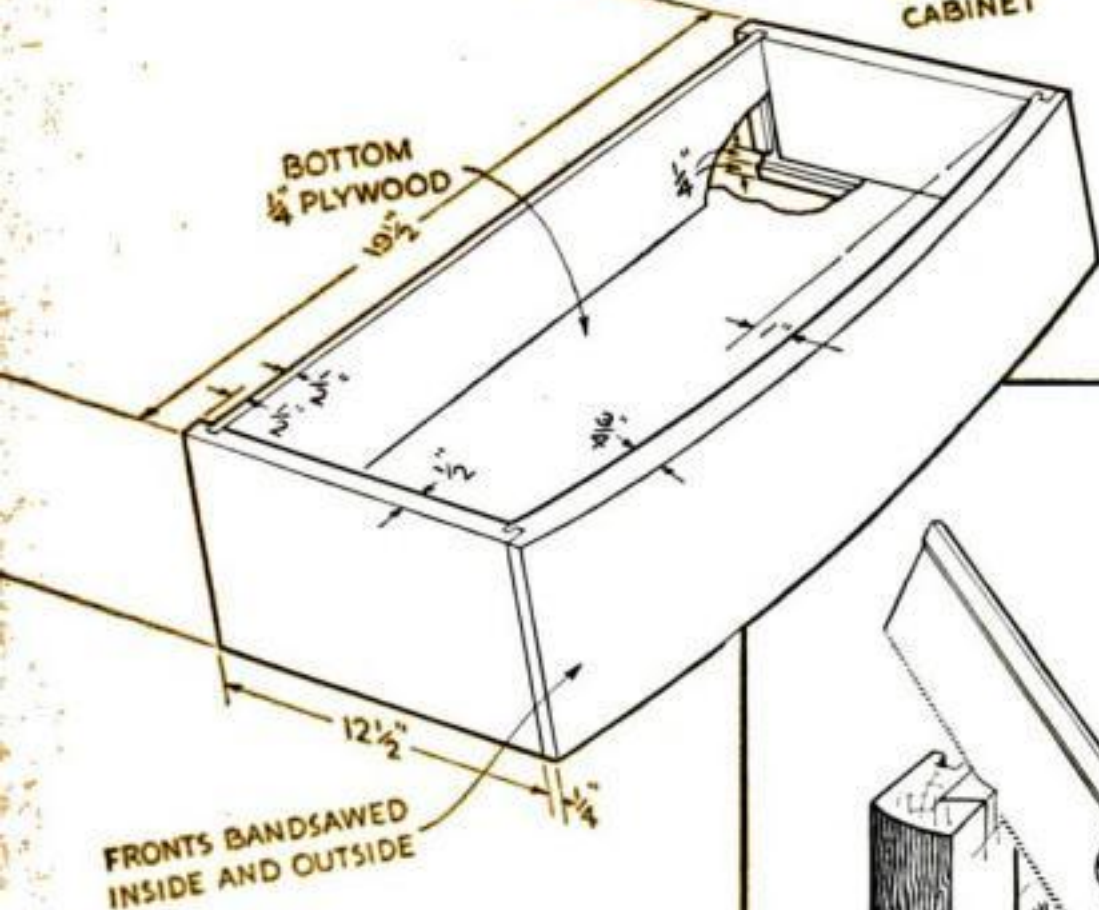
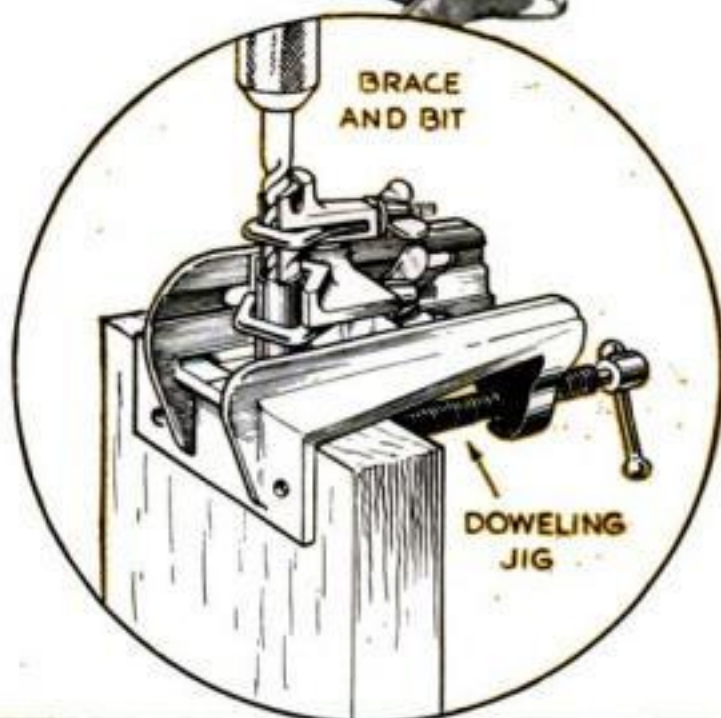
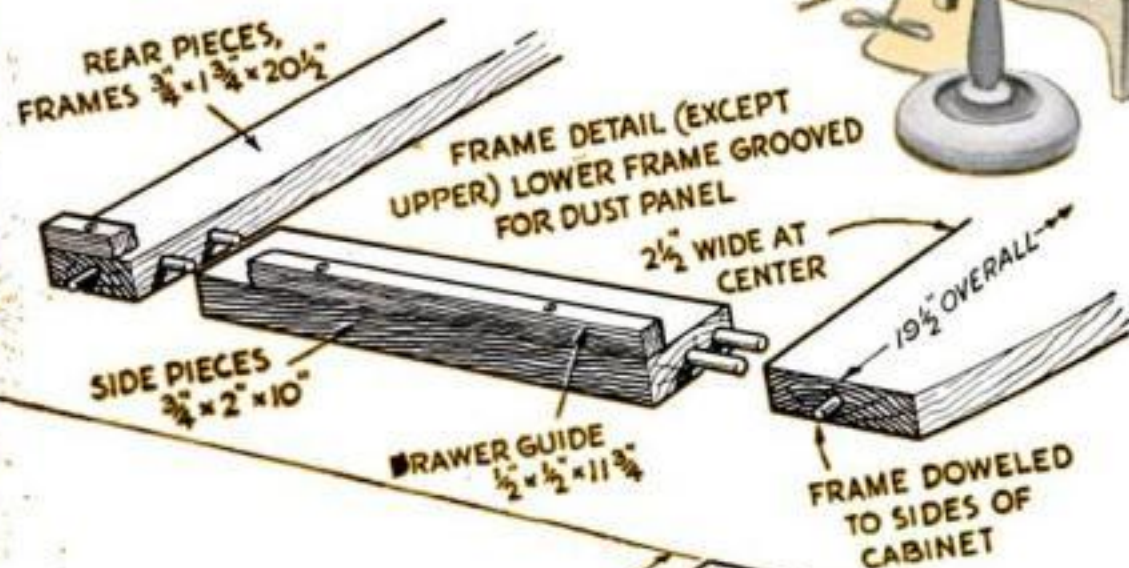
SPACE-~~SAVING~~

Designed by
**HERMAN
HJORTH**

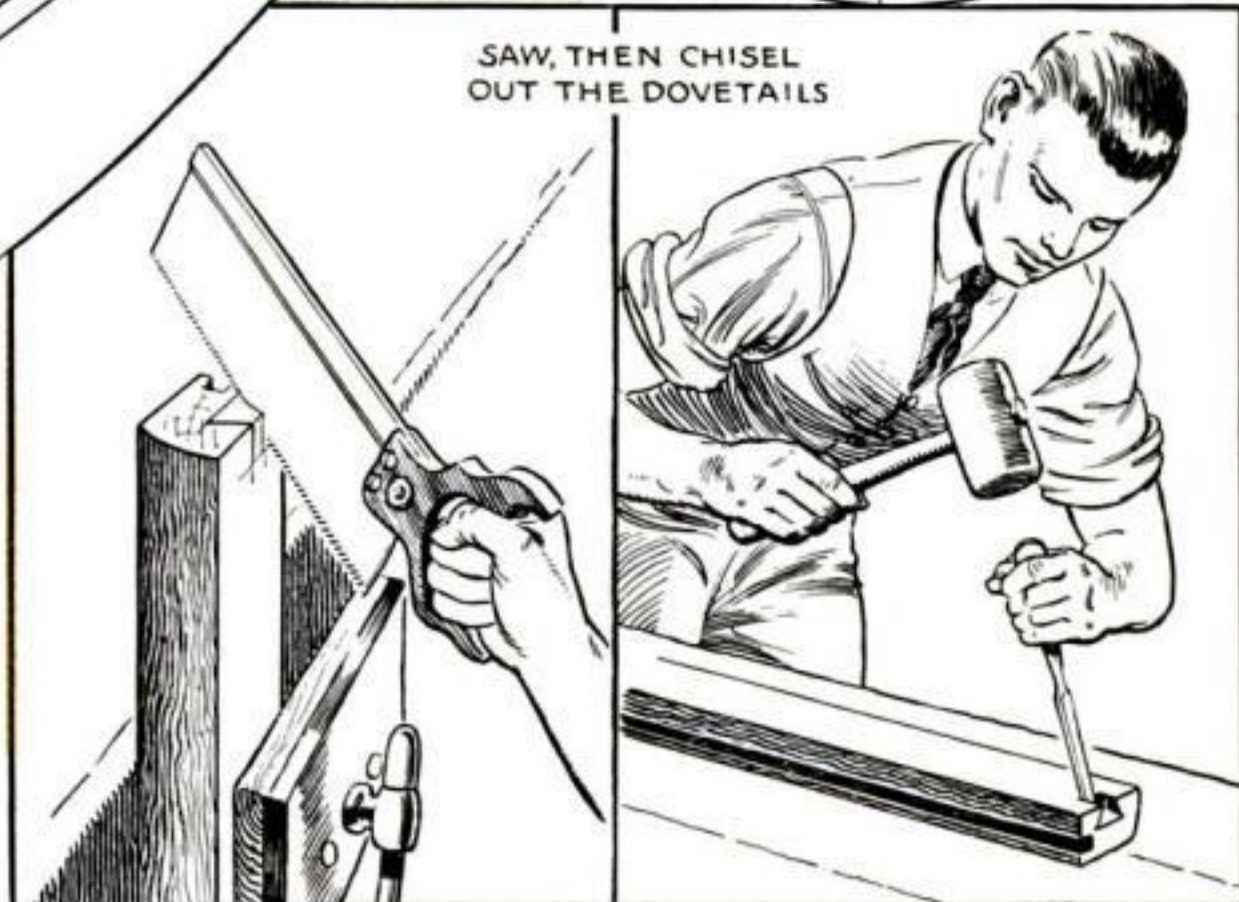


Girl's Room

Mahogany, walnut, maple, gum, or other cabinet wood may be used for this make-up chest, which is intended for a small bedroom or for occasional use when guests are entertained and an extra dressing table is needed. The mirror is fastened to the underside of the top, and a stay hinge is fitted to hold it at any desired angle. The two sides are grooved into the front legs and connected by five frames. Four of these are alike and joined to the sides with dowels; the lower one is also grooved for a dust panel; and the fifth, or upper one, is dovetailed into the legs and sides, and has a panel. If desired, the front can be straight

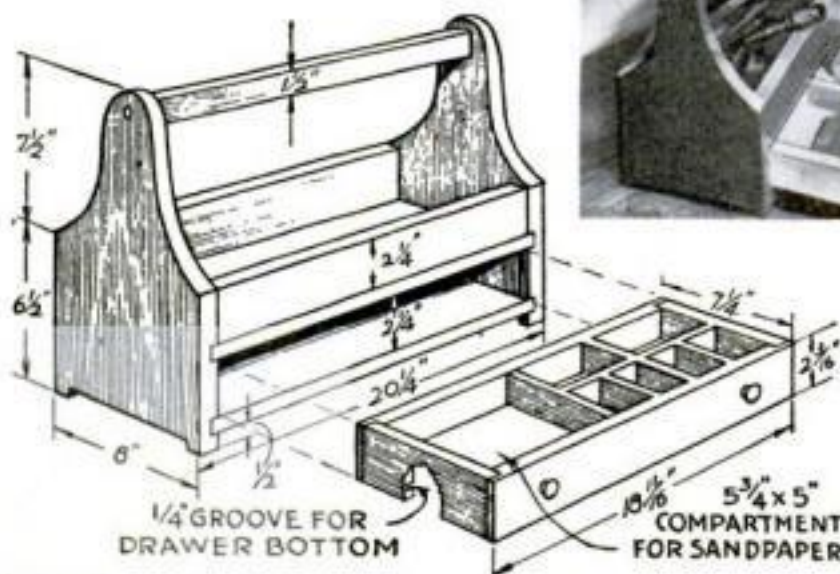
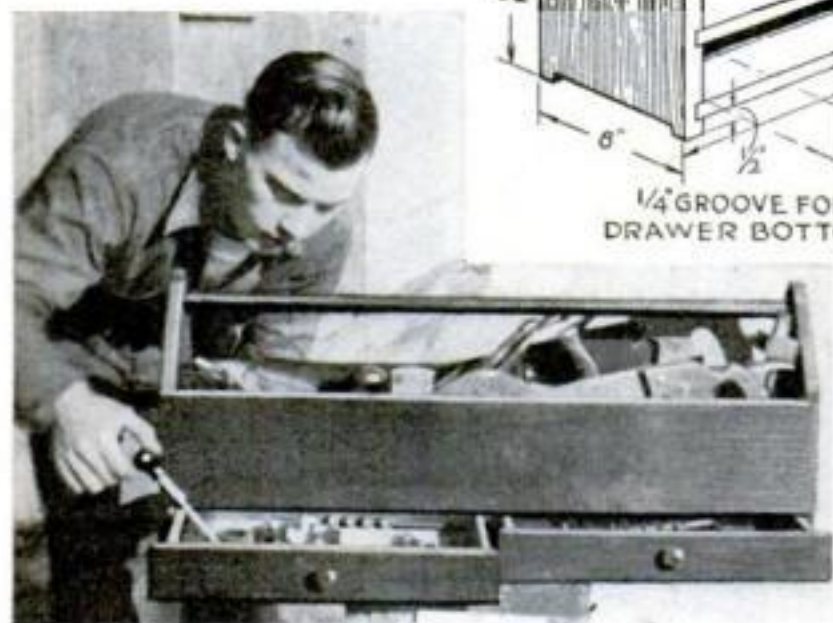


If the piece is made with a curved front as shown, material can be saved by band-sawing all the drawer fronts from a solid block. This can be glued up from several pieces if it is intended to veneer the fronts



Drawers Improve Tool Boxes Used for Repair Work

FOR repair work in and about the house or farm, it is convenient to have a portable tool box with one or two shallow drawers or trays to hold small hand tools and the like. The drawings give dimensions for a small household tool kit. The two ends are band-sawed and dadoed $\frac{3}{8}$ " deep and $\frac{3}{4}$ " wide to receive the tray bottom and drawer slide, both of which measure $\frac{3}{4}$ " by 8" by $19\frac{1}{2}$ ". They are glued and nailed in place. Cut three pieces $\frac{3}{4}$ " by $2\frac{1}{4}$ " by $18\frac{3}{4}$ " for the sides of the tray section and drawer stop. The handle is $\frac{3}{4}$ " by $11\frac{1}{2}$ " by $18\frac{3}{4}$ " and is fastened with screws. Construct the drawer as shown and divide into sections.

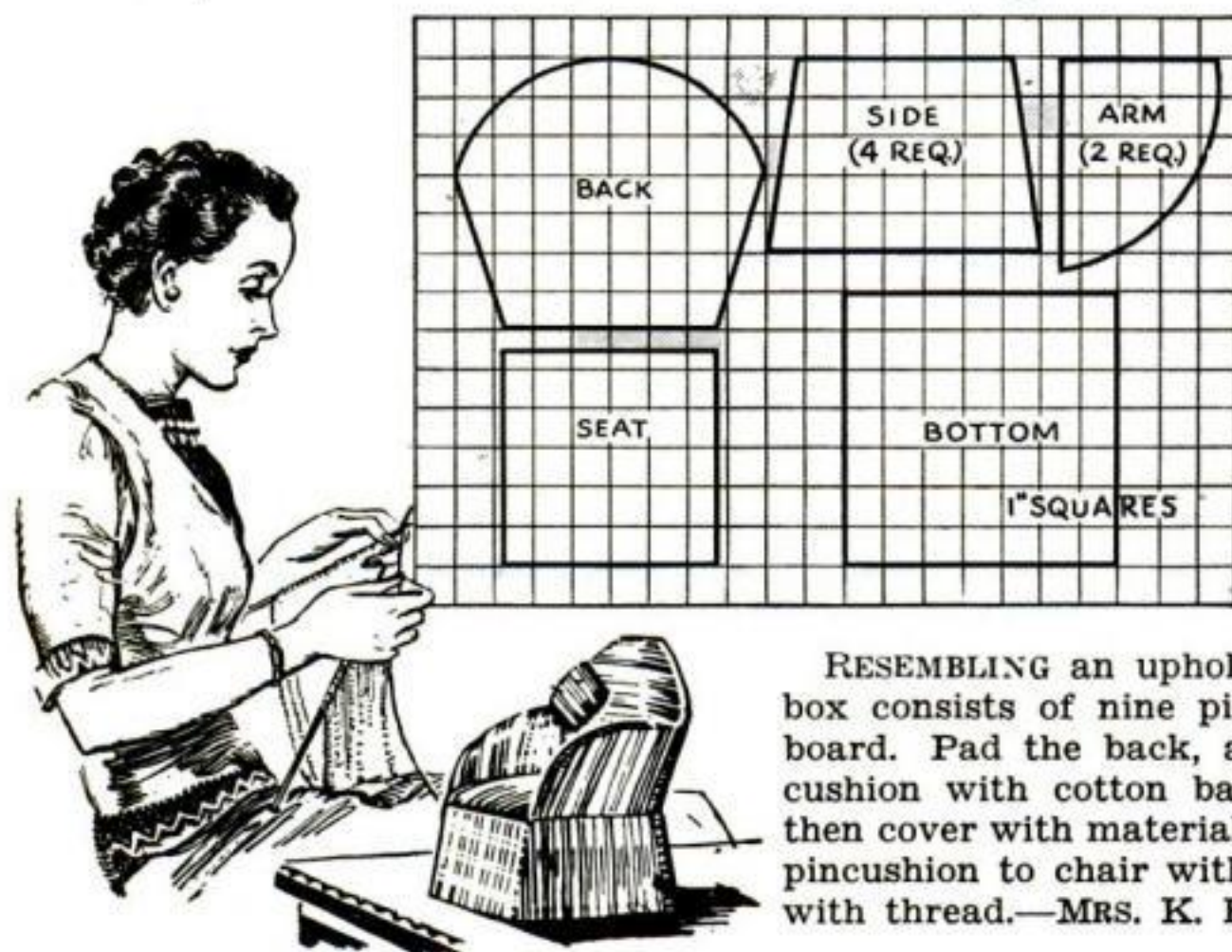


A small household tool kit is kept immediately accessible in this box with its shallow drawer. In the photo at the extreme left is shown a larger but similar box

Rain Cap for Battery Charger

A STANDARD make of wind-operated battery charger gave trouble because rain entered the front bearing, causing rust. This was ended by cutting a hole in an empty coffee tin to fit the shaft and slipping the tin over the end of the generator.—W.S.S.

Tiny Chair Serves as Sewing Box



RESEMBLING an upholstered chair, this sewing box consists of nine pieces of corrugated cardboard. Pad the back, arms, seat, and tiny pincushion with cotton batten and sachet powder, then cover with material to suit the taste. Attach pincushion to chair with pins or hold it in place with thread.—MRS. K. R. SIPPLE.

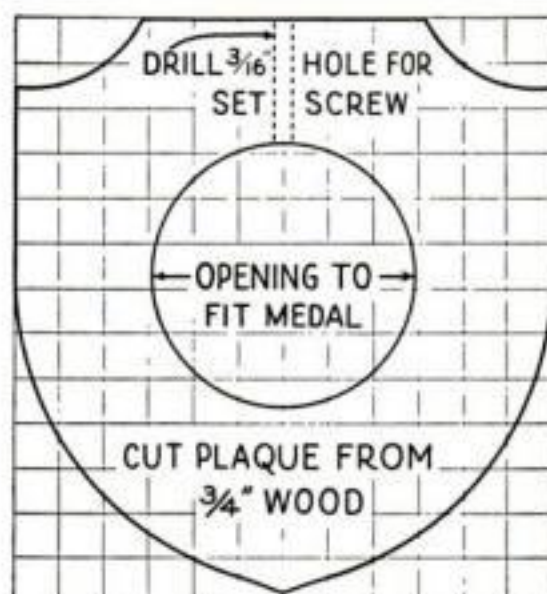
Large Medal Displayed in Reversible Plaque

IF YOU have received the American Legion School Medal or any similar award, it may be attractively displayed in a reversible walnut or mahogany plaque of the type shown. The opening for the medal can be cut with an expansion bit, if available; otherwise it may be sawed out and accurately filed and sandpapered to a snug fit. The set screw, which is made from a $\frac{1}{4}$ " carriage bolt, is allowed to cut its own thread in the $\frac{3}{16}$ " hole in the wood. For the chain, obtain from a plumbing supply house a 9" length of ball

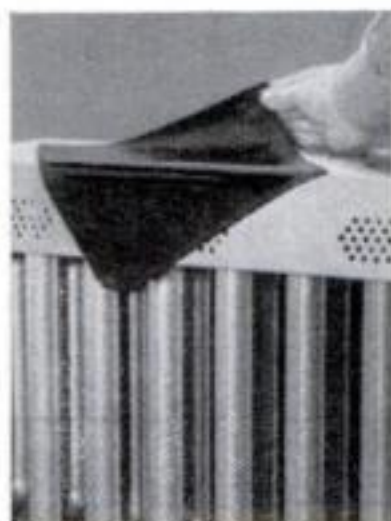
chain of the variety used in attaching sink stoppers to fixtures. Sand the plaque on both sides and stain, fill, and varnish it; or rub in a coat of linseed oil.—GEORGE A. SMITH.



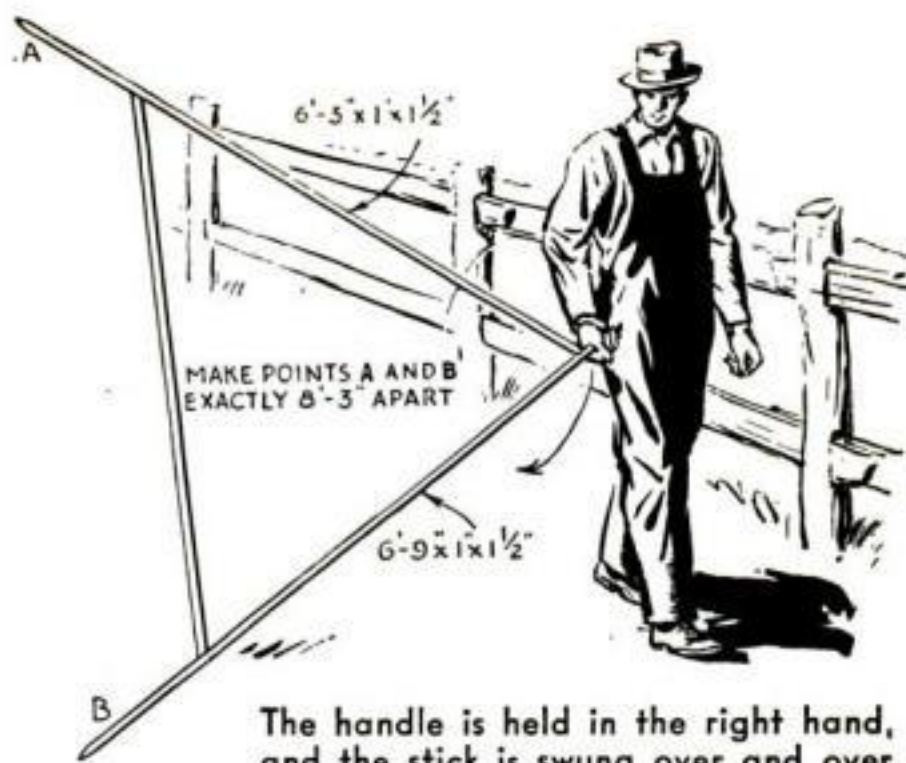
Layout of the wooden plaque and how the set screw is made



Old Carbon Paper Heated to Renew Its Surface

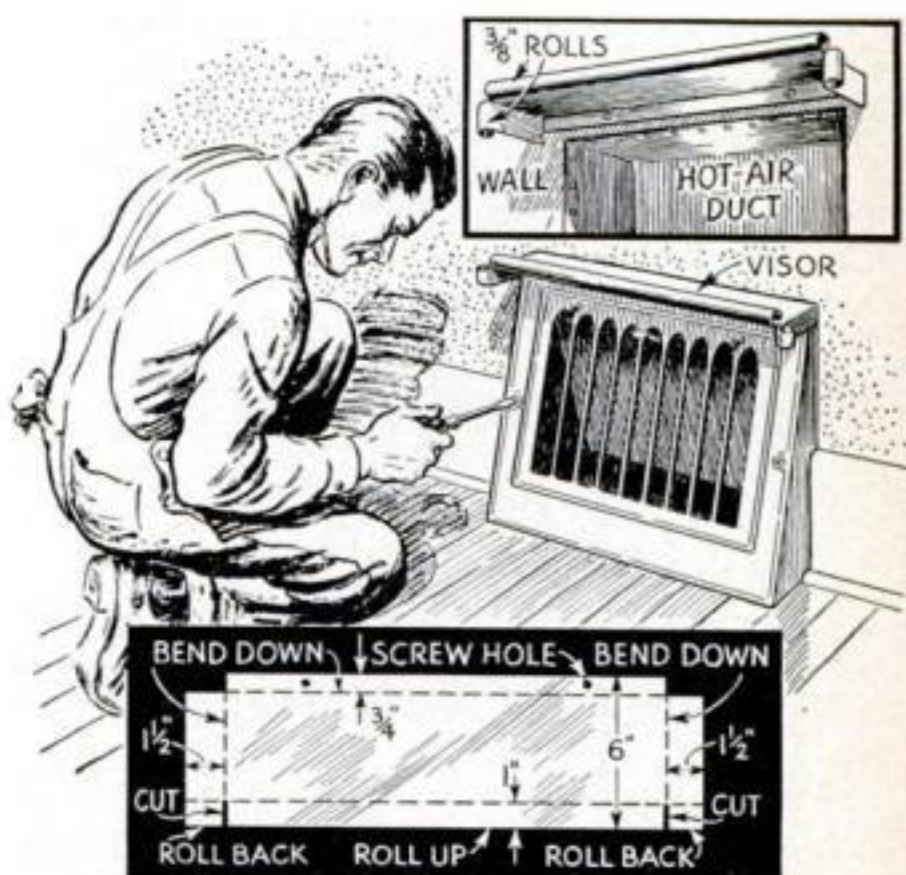


IN AN emergency a badly worn piece of typewriter carbon paper can be made usable by heating it over a radiator or a very low gas flame. The heat softens the ink and causes it to run together smoothly again, eliminating worn spots.—W. S.



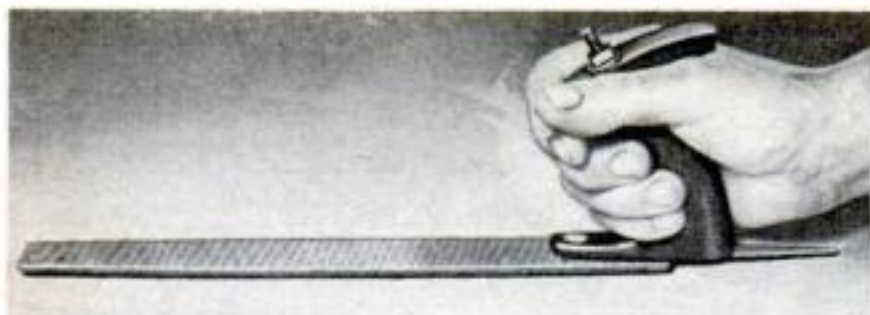
Giant Wooden Dividers Measure Acreage

BY USING the giant dividers shown, one person can measure the acreage of a tract of land almost as fast as he can walk along two sides of it. The points are brought down each time at approximately the same distance from the fence or line of measurement. Each turn of the stick measures off exactly one-half rod. Eighty spaces thus equal forty rods or the length of the side of a square one-acre plot.—CLIFFORD W. BERG.



Dust Visor for Register

EVERY home owner who uses a hot-air furnace will appreciate the 18-gauge sheet-metal visor shown above. It eliminates the smoke and dust streak on the wall above heat registers by directing the warm-air currents away from the wall and out farther into the room.—EVAN W. BAKER.

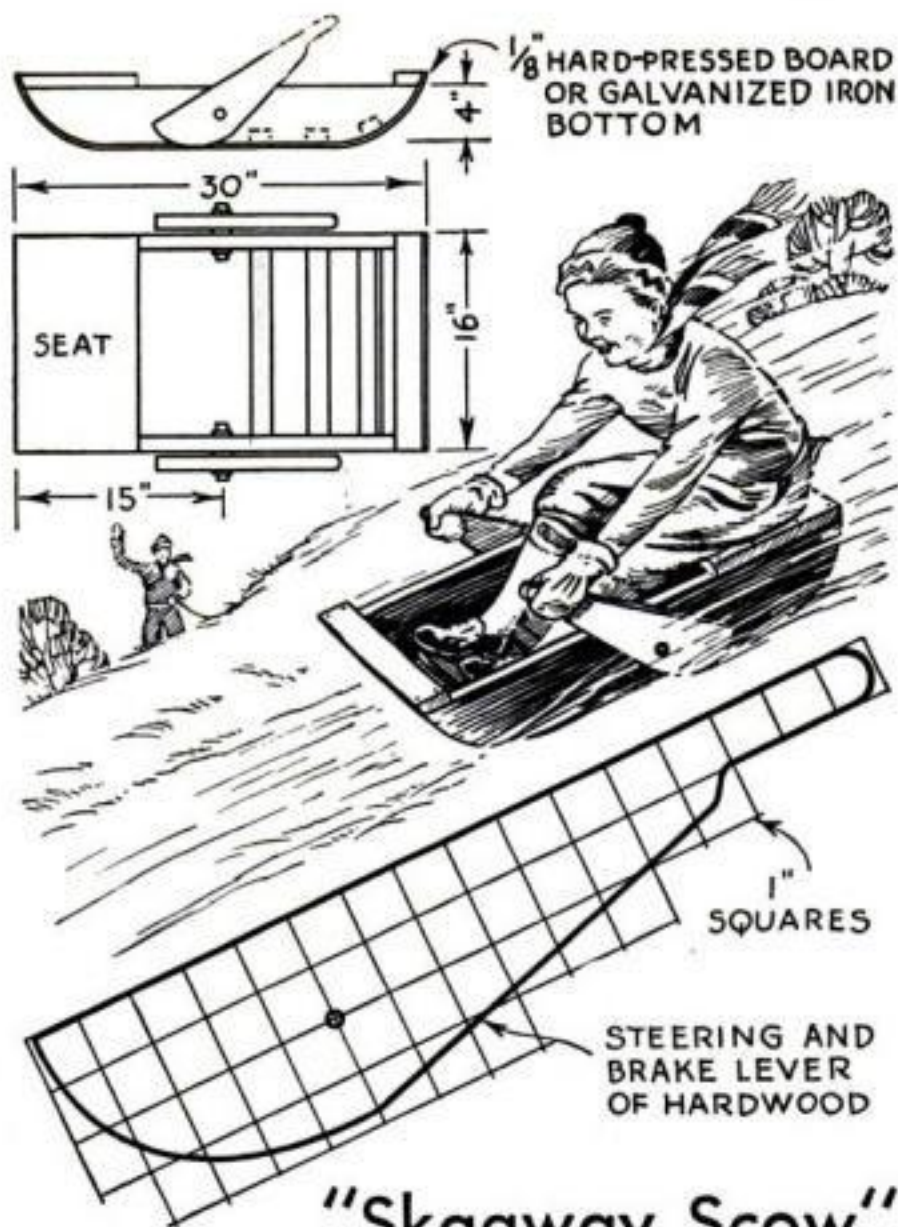


Handle Attached to File for Flat Surfaces

FILING large, flat surfaces is easier if a wooden handle, taken from an old plane, is attached to the file. A hole is drilled in the tang of the file to take a stove bolt long enough to reach through the handle.

Pliers Force Brads into Picture Frame

FOR inserting small brads in the back of a light picture frame, a pair of slip-jaw pliers are more convenient than a hammer. Open the pliers to the "wide" notch, hold the nail in position with the other hand, and apply a firm, steady pressure. The outer jaw of the pliers may be padded.



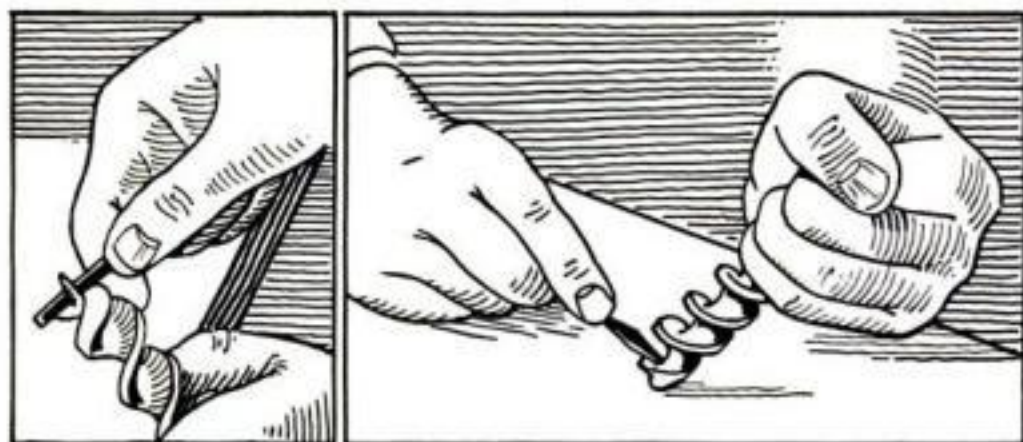
"Skagway Scow" Scoots Over the Snow

SO-CALLED "Skagway scows" are fun-provoking snow coasters made without runners. The one illustrated above is of especially simple construction. The bottom may be either hard-pressed composition board $\frac{1}{8}$ " thick or a piece of galvanized iron. The two hardwood side levers enable the scow to be steered or braked to a standstill.—H. S.

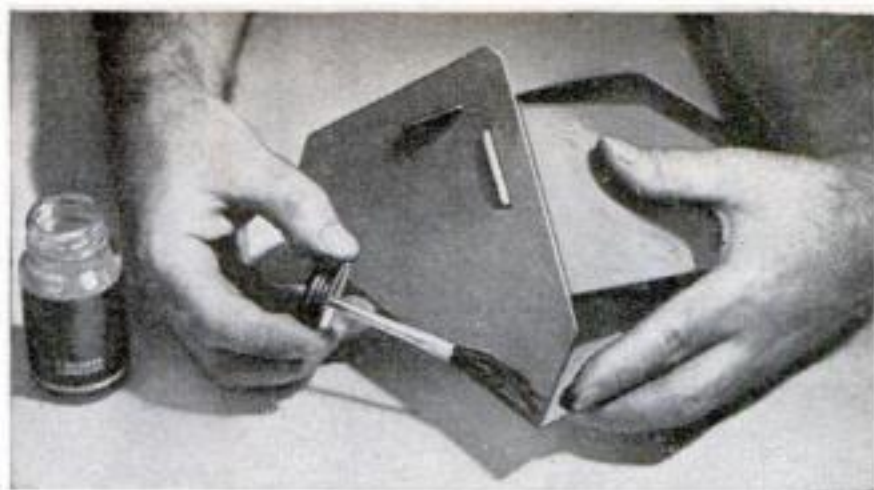
SHARPENING AUGER BITS

[WOODWORKING]

Dull or damaged auger bits may be sharpened with a small flat file or an auger-bit file. The spurs are the vertical cutting edges which score the circle before the horizontal cutting edges, called the lips, cut into the wood. 1. Hold the bit against the edge of the bench with the cutting end above it and file the spurs on the *inside* until a fine burr is formed. Remove this by rubbing the outside of the bit lightly with a slip stone. 2. File the lips on their *upper* sides while holding the bit at an angle and resting the screw on the bench top. Remove the burr as before.



POPULAR SCIENCE MONTHLY SHOP DATA FILE



Rubber Cement Prevents Folder from Slipping

ONE of the objections to mounting photographs in cardboard folders with easel backs is that a gust of wind easily causes them to slide to the floor when placed on a polished piano top or table. Give the bottom of each folder a coat of ordinary rubber cement and the trouble is overcome, because the cement provides a nonslip surface which is not harmful to the furniture.

Cork on Auger Bit Acts as a Depth Gauge

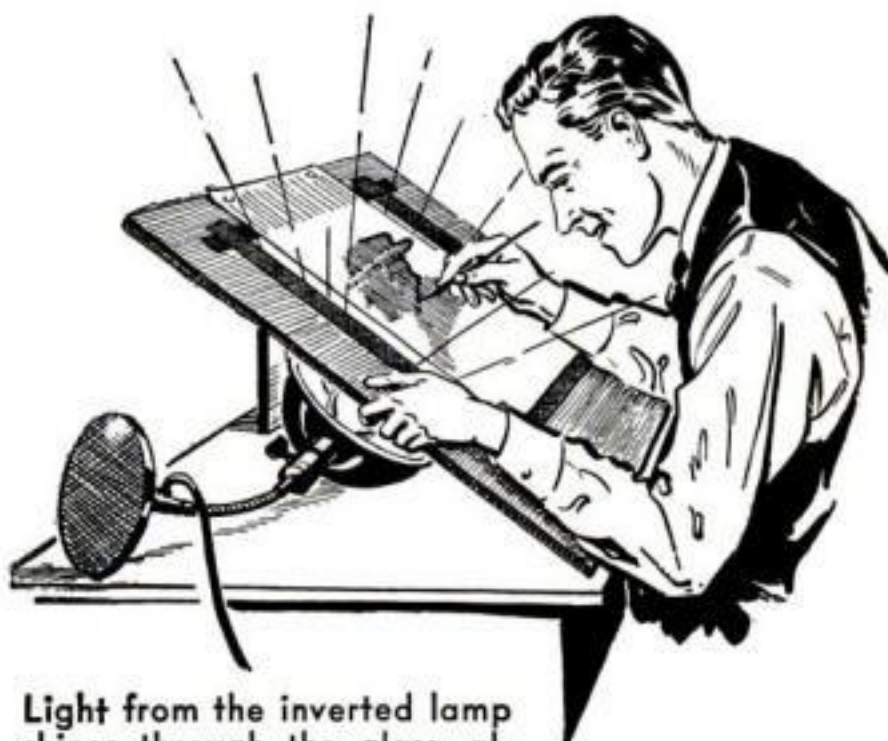


FOR boring holes by hand to a certain definite depth, simply screw the bit or drill into a cork. This will act as a firm depth gauge. Corks of various sizes can be used for different bits and drills. It pays to keep several in the tool box.—L. L. T.

A Glass Drawing Board for Stencil Tracing

DRAWINGS and diagrams can be traced on duplicator stencils by using a sheet of plain or ground glass taped in place over an opening in a piece of wall board. This is propped up over an inverted desk lamp as illustrated below.

For permanent use, set the glass in flush with the surface of the wall board and tack reinforcing strips around the outside of the board and under the glass. I prefer this type of device to an expensive tracing outfit because it takes little room and can be set up at any convenient angle right on my desk. A wooden prop may be hinged to the back for convenience.—FRED CARTER.



Light from the inverted lamp shines through the glass, allowing drawings to be traced

NUMBER OF WIRES IN CONDUITS

[ELECTRICAL]

When wiring is to be done in conduit or thin-wall tubing, it is necessary to know the number of wires allowed in the various sizes of conduits. An attempt to use too many wires will cause difficulty in pulling them into place and may damage the insulation. The following table shows how many conductors of various sizes can be used in conduits of $\frac{1}{2}$ " to $2\frac{1}{2}$ " sizes.

Size or wires	Number of conductors in one conduit or tubing								
	1	2	3	4	5	6	7	8	9
18	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$
16	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$
14	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1
12	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	1	$1\frac{1}{4}$
10	$\frac{1}{2}$	$\frac{3}{4}$	$\frac{3}{4}$	$\frac{3}{4}$	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$
8	$\frac{1}{2}$	$\frac{3}{4}$	1	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$
6	$\frac{1}{2}$	1	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	$1\frac{1}{2}$	2	2	2
4	$\frac{3}{4}$	$1\frac{1}{4}$	$1\frac{1}{4}$	$1\frac{1}{2}$	2	2	2	2	$2\frac{1}{2}$

POPULAR SCIENCE MONTHLY SHOP DATA FILE

PINOCCHIO

HOW TO DUPLICATE THE AMUSING

PINOCCHIO, the wistful puppet created by Geppetto, the wood carver, in Walt Disney's second full-length production, is an inviting subject for either a homemade puppet or an amusing and companionable little doll. The accompanying illustrations show how to go about making one patterned after the original, which was created by the Disney model department as an inspiration to the animators drawing Pinocchio.

If you are an expert wood carver yourself, the head might

be fashioned from a solid block of soft white pine and the nose inserted (Fig. 1), but a surer way to achieve a fair likeness is first to make a clay model. From this a plaster-of-Paris mold is taken, and the head is cast in plastic composition wood (Figs. 2, 3, and 4). The hat is made in the same way as the head and glued on.

The casting process will be found simple if the steps are carefully carried out as illustrated. Note, however, in the step marked Fig. 4E



By
HI SIBLEY

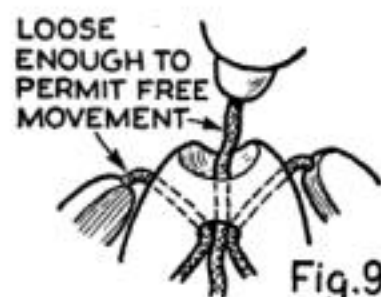
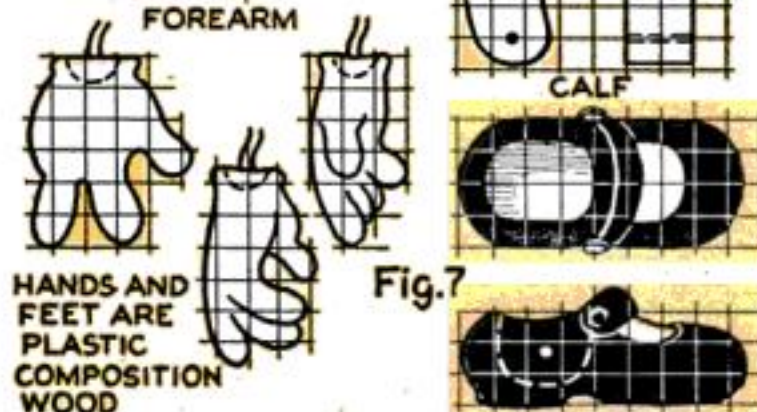
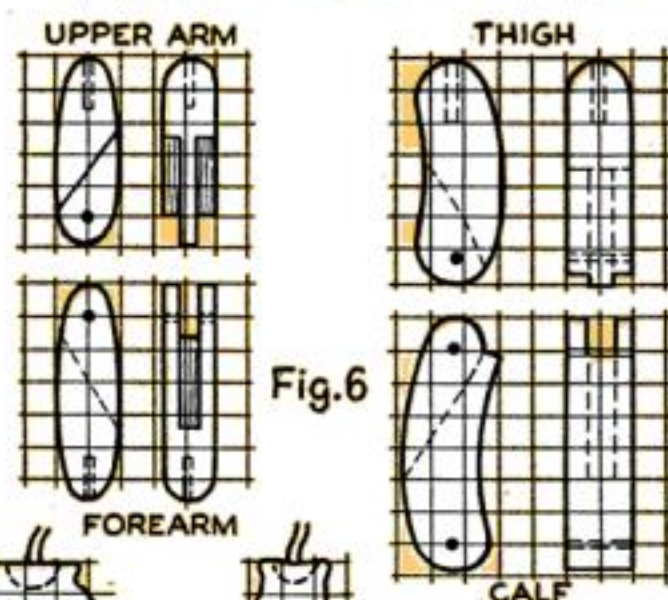
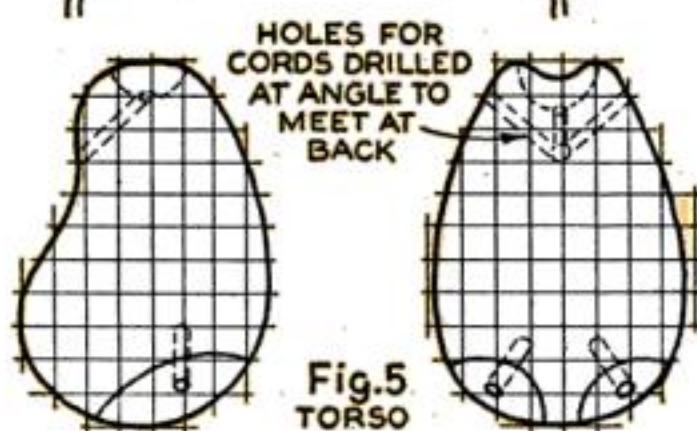
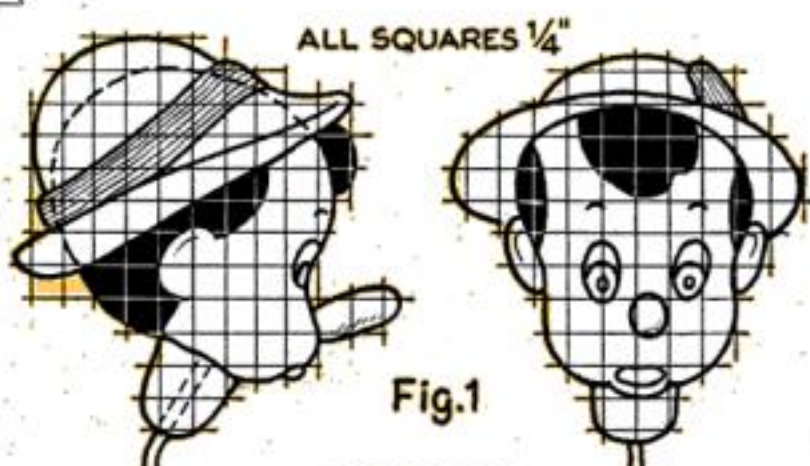


Fig. 9
METHOD OF DRAWING UP
HEAD AND ARM CORDS

If you want to make a 9" tall Pinocchio, lay out $\frac{1}{4}$ " squares for copying the various parts. Change the squares to $\frac{3}{8}$ " for a $13\frac{1}{2}$ " model



Fig. 8

BRASS
PIN

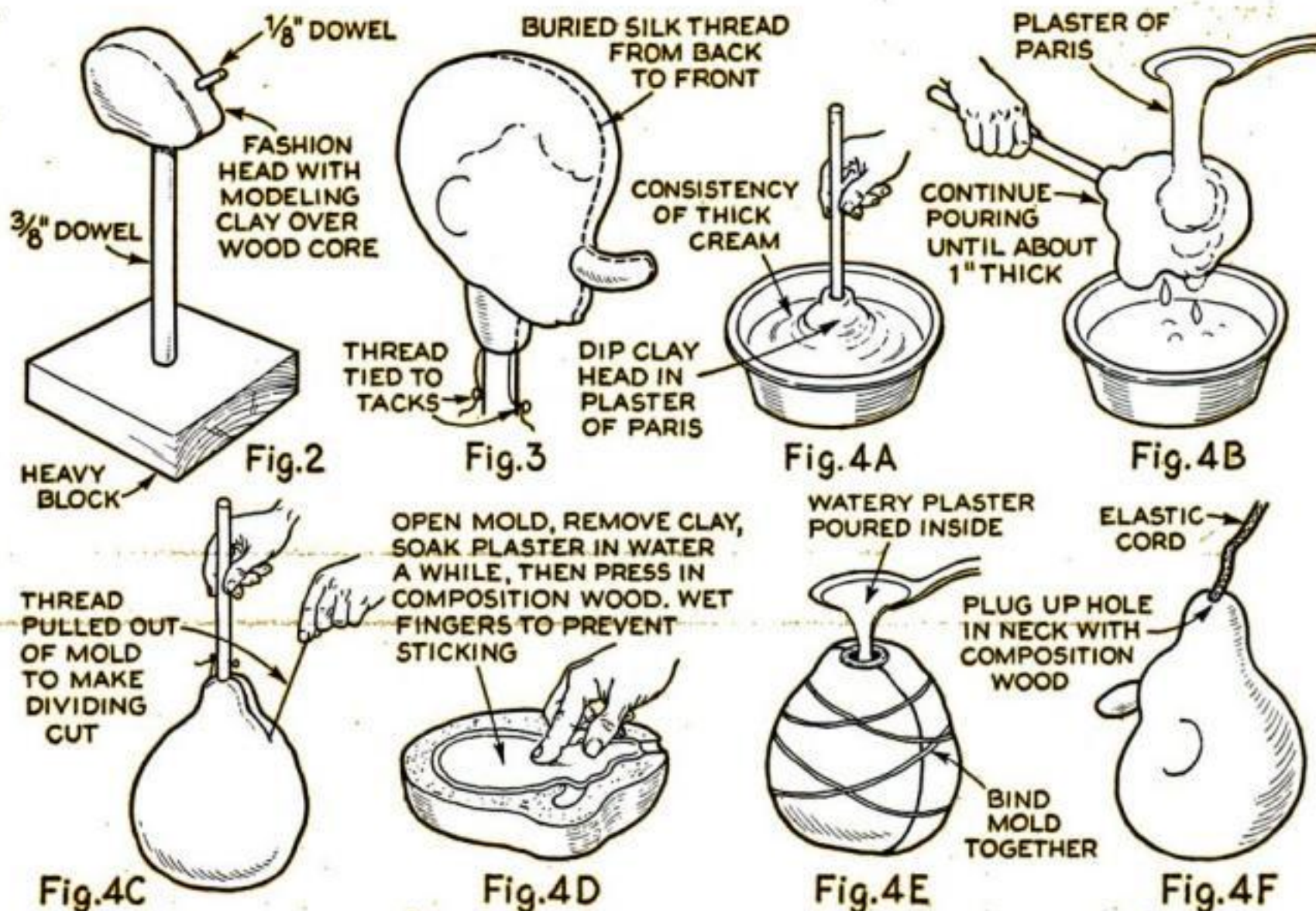
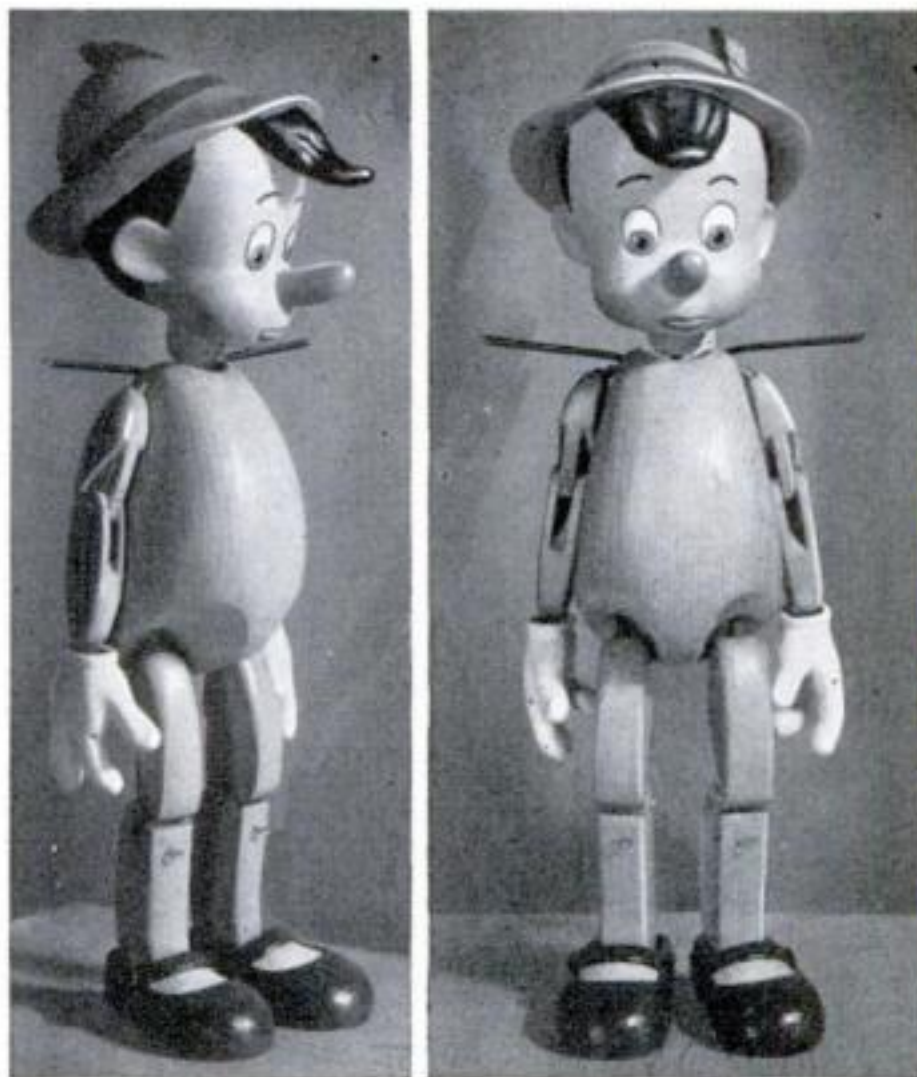
the PUPPET

LITTLE MODEL WALT DISNEY'S ANIMATORS USED

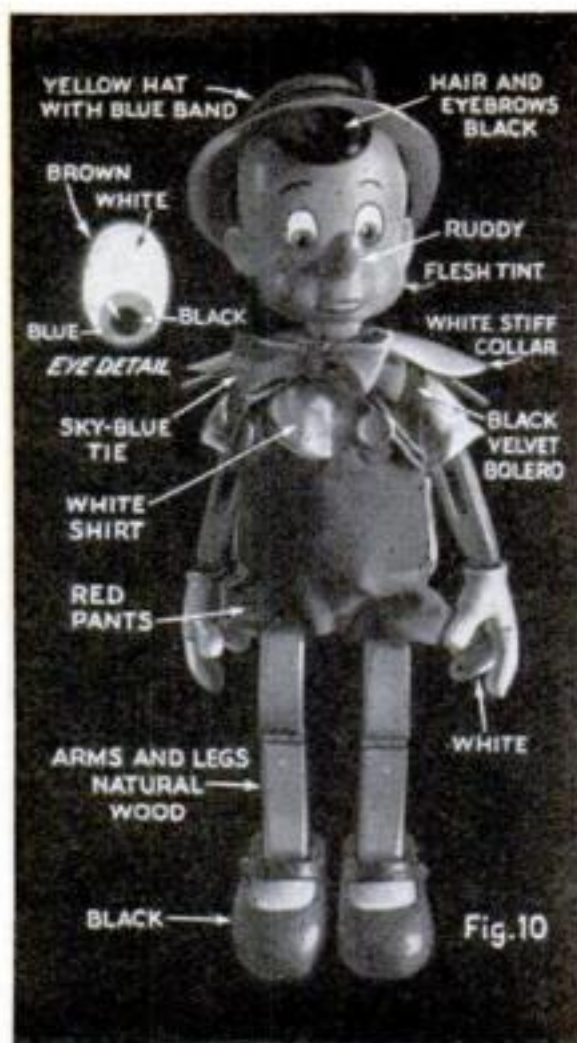
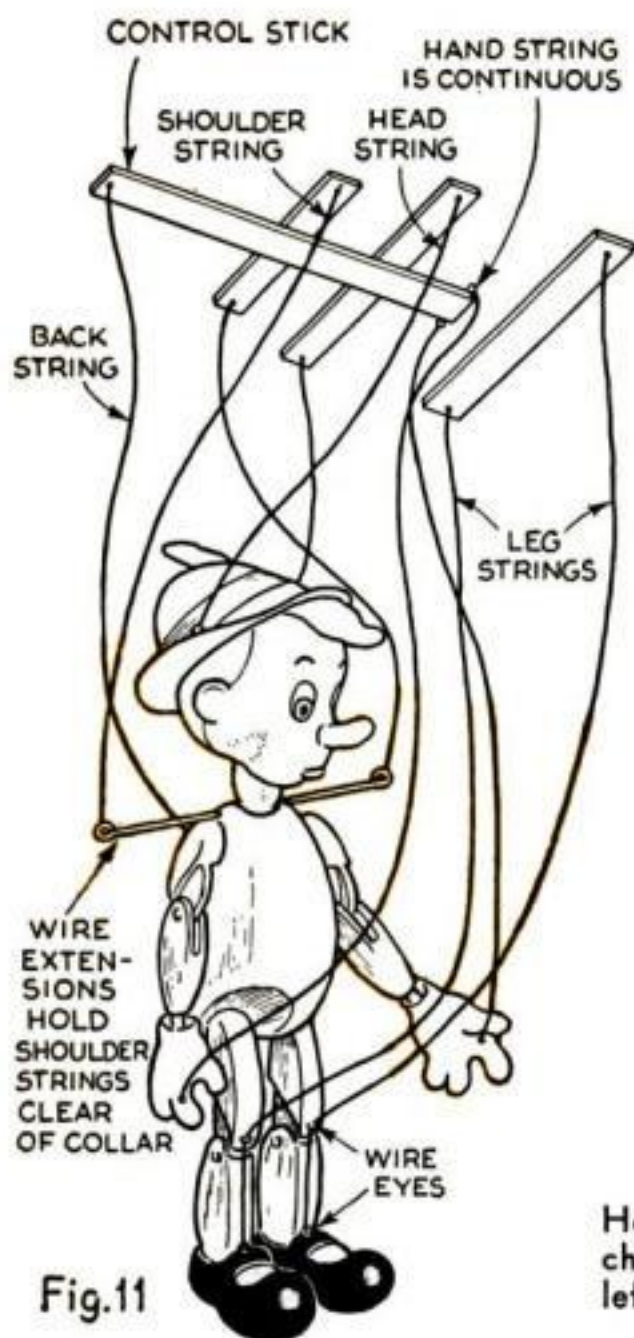
it is not necessary to fill the mold with watery plaster. Just pour a little inside and swish it around to form a coating and prevent the wood composition from drying and shrinking. The joint where the two halves of the head come together should be filled and the whole sandpapered before painting.

The torso is carved from a solid block of soft white pine (Fig. 5), and holes are drilled as indicated for the thongs to which arms and legs are attached, and for the elastic in the neck. The latter is a sort of ball-and-socket joint so that it may be turned and twisted within reasonable limits.

Legs and arms are of maple, although if they are to be painted flesh color, white pine will do. These pieces are slotted and jointed as in Fig. 6. For a doll, make the slots



Step-by-step sketches to show the method of modeling and casting the head. The hat is made similarly



How to color and costume Pinocchio in suitable street attire. At left are the marionette controls

fit snugly so they will remain in any desired position, but for a marionette the joints should be very loose.

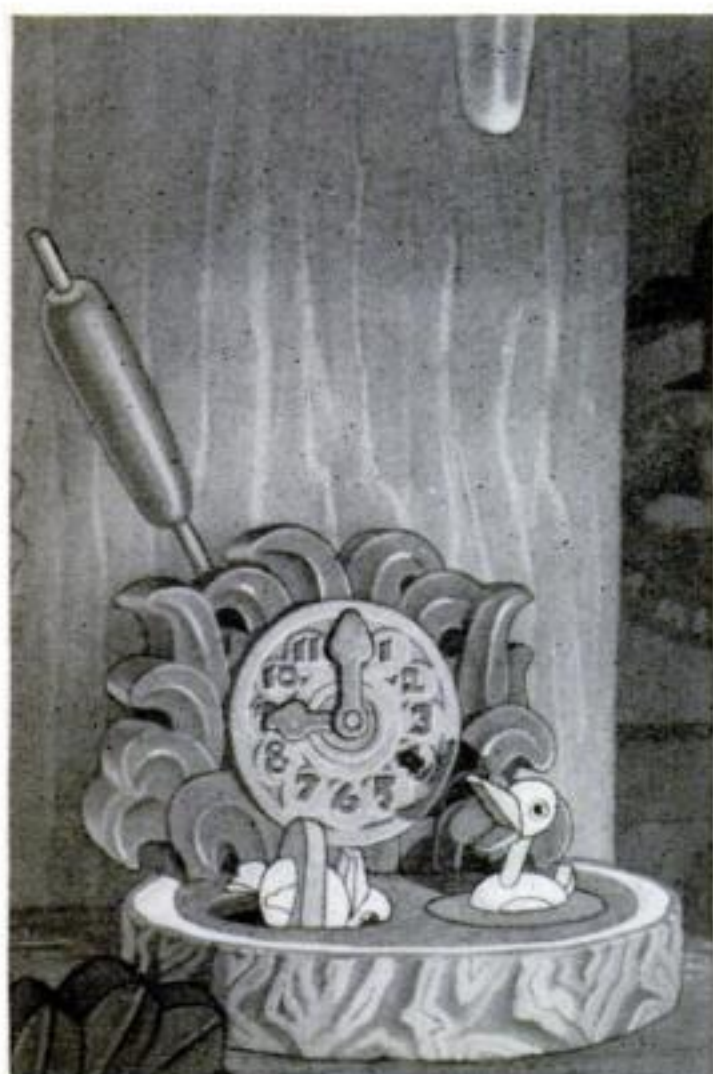
Hands and feet are cast in the plastic composition like the head, and the shapes are given in Fig. 7.

The assembly is illustrated in Fig. 8. Raw-hide thongs are driven into holes in the upper arms and thighs, and fastened with glue or thin wedges. Costume and coloring are shown in Fig. 10.

There are various methods of attaching strings to a figure of this kind if it is to be used as a marionette, but one of the simplest is shown in Fig. 11. The wire extensions for the shoulder cords have the

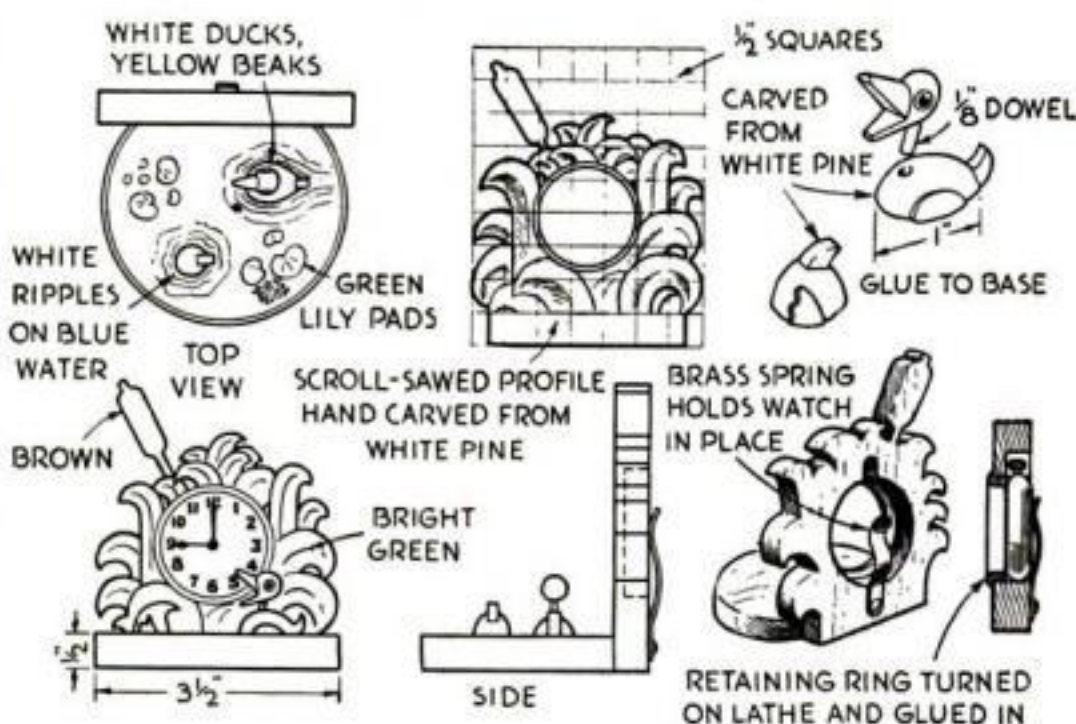
advantage of giving better control and hold the strings clear of the stiff white collar.

And Here Is a Colorful Little Clock by Geppetto



An original Geppetto clock and, at the right, a simple adaptation of the design for holding a dollar watch

GEPPETTO, the indefatigable wood carver who made Pinocchio, filled his shop with all manner of unique cuckoo clocks. This one can be adapted to serve as a desk ornament. A hand-carved background of rushes supports a dollar watch, and in the foreground is a painted pool with a pair of ducks, one of them "headin' south." Jig-saw the back wall from white pine and carve in the design. The watch is set in a circular opening, being held in place by a brass spring. If a lathe is available, turn the retaining ring of hardwood; otherwise carve it out. The ducks are whittled from white pine.





Workshop Clubs Increase Activities as New Year Begins

• • •

INTENT on getting the most out of their hobby, thousands of amateur craftsmen throughout the United States and Canada are participating in a variety of interesting programs arranged by their local home workshop clubs. Reports to the National Homeworkshop Guild from club secretaries indicate that more activity is taking place

at present than ever before. The Christmas toy project has been successfully completed, and now the members are turning their attention to other projects. Here's the latest summary of news prepared by the Guild:

LEROY, N. Y.—Two prizes are given each month for the best projects made by members and exhibited at the meetings. All the monthly winners will be eligible for competition for a grand prize to be awarded March 11. Joseph Kibler is contest chairman, assisted by R. S. Kellogg, George J. Sequerth, Vincent Lapp, and H. L. Canfield. The fifth annual display contest is scheduled for March 25 to 30.

SEATTLE, WASH.—"We are planning a big year and hope to get several prominent speakers; also silent and sound moving pictures," reports E. R. Landers, who was recently elected secretary-treasurer. The other officers are M. L. Eggleston, president; Harold Wirkman, vice president; G. F. Fitzgerald, librarian; E. E. Park, shop foreman. Post cards listing coming events are mailed to the members periodically.

NATION'S CRAFTSMEN FLOOD GUILD OFFICE WITH REPORTS



FEBRUARY, 1940

183



NEW BEDFORD, MASS.—Separate benches for all members of the Timbercraft Club are being constructed in the club workshop. A fund is being raised to purchase additional power tools. Members have been requested to report to the secretary

all the major projects they make. Last year's total was fifty-two.

CHICAGO, ILL.—Members of the Way Homeworkshop Club have completed their lawn-ornament project.

PEEKSKILL, N.Y.—Leonard H. Buckton, industrial arts instructor at the high school, demonstrated sand molding. After explaining various units of equipment and the details of preparation, he made castings of brass and a zinc alloy. The club celebrated its sixth anniversary with a dinner in November. A recent meeting was held at the home of Fred Gallagher, who exhibited his equipment for polishing woods and metals. Another meeting was held at the home of Thomas Monteleone. Mr. Buckton showed moving pictures.

PUT-IN-BAY, OHIO—“The club has rebuilt part of the school basement and is making it into a shop,” reports Secretary Edward Cooper. “We have built two brick walls and are now erecting a fireproof door between the furnace room and the shop. Local organizations are contributing tools for our use.”

NEWTON, MASS.—Recent meetings of the Homecrafters have been held at the homes of Bruce Bear and Fred Ryer. Browning Baker demonstrated uses of wood-turning tools, and Mr. Cole talked on plywoods and veneers.

BEAVERLODGE, ALTA., CANADA—

Projects completed by members include collapsible tables, coat racks, bookcases, flower stands, and end tables. “The workmanship is still slightly amateurish, but is improving gradually,” Secretary Hubert Sumner says.

SHREVEPORT, LA.—“Our membership consists of professional men who like diversion from their daily work,” reports S. K. Ward. “Last year we had 27 members; this year we expect to reach 50 and to organize two hobby classes. H. F. Rush of the Shreveport Trade



School is in charge of the present class, which meets two nights a week.” E. Catalano is president; Dr. Fred Rutzberg, vice president; and Mr. Ward, secretary-treasurer.

SHENANDOAH, PA.—A club shop has been established in the basement of the home of Joseph J. Polityka, secretary. Wall bookcases, with desk and chair to match, are being constructed at present. The design is a modern and original one.

OKLAHOMA CITY, OKLA.—A moving picture “The Potter’s Wheel” was shown recently, and a demonstration given of screw cutting on the lathe.



The club expressed sympathy to S. Tolley, a member, who lost his mother when the S. S. *Athenia* was sunk.

QUANAHA, TEXAS—A piece of furniture will be auctioned off, and half the proceeds given to the Community Chest. Toys for the local poor children made by members were displayed in a store window before they were distributed.

OTTAWA, ILL.—Robert Burns, local representative of a promi-

nent lathe works, demonstrated how to use a metal-working lathe and exhibited several models he had made that are operated by steam and gasoline power. Roland Kleinhans, of Utica, Ill., exhibited a partially completed model steam locomotive he is working on. The meeting was held in the shop of Ivan Warrick. The following meeting was held at the South Ottawa Town Hall where Dick Littleman demonstrated metal and woodworking power tools, and showed the members how to use them.

CANTON, ILL.—Harold Johnson, high-school instructor, talked on metal spinning and was so well received that a subsequent meeting was held at the high-school shop, where he gave a demonstration. New officers are Keith Hickman, president; Dale McLain, vice president; D. V. Tolle, secretary-treasurer; Scott Shroyer, librarian; John Hardin, publicity chairman.

DAYTON, OHIO—Toys made by the Gem City Homeworkshop Club for the city’s poor children were presented to the Junior Chamber



of Commerce at a dinner in December. Toy ducks, wheelbarrows, chairs, doll beds, games, and small ironing boards were among the 200 toys. Frank Lehman won an award for a circus wagon he had made from a cheese box.

LYNN, MASS.—New workshop equipment has been purchased for the club's shop. Plans are under way for holding an open house soon. President R. A. Barbeau recently demonstrated how to turn Queen Anne legs for furniture. Reports for the past season show that A. Gilbert completed the greatest number of projects. J. Termini, it was decided, had shown the greatest improvement in wood-working.

COLUMBUS, OHIO—Carl L. Phalor has been elected president of the Homecraft Club, writes Tudor Wilson, corresponding secretary, who says: "A large part of the club's success has been due to Mr. Phalor's



whole-hearted devotion to the promotion of the club during his secretaryship of several years. Tribute must also be paid to the retiring president, Dr. William T. Palchanis, for the splendid programs he arranged last year." The annual meeting was held at the Southern Hotel, and reports were given on last year's toy project and the successful showing the club made at the Columbus Hobby Show. Other officers elected were Homer Faust, vice president; F. E. Hoop, secretary-treasurer; W. S. Lynch, Dan D. Fulmer, and Ralf Sears, board of governors.

BLOOMFIELD, N. J.—William Hassel told the members of the Berkeley Homeworkshop Club about his hobby of collecting and making replicas of old locks.

RACINE, WISC. — The club hopes to have a permanent location soon. An exhibition of soap carving was given by LeRoy Smith.

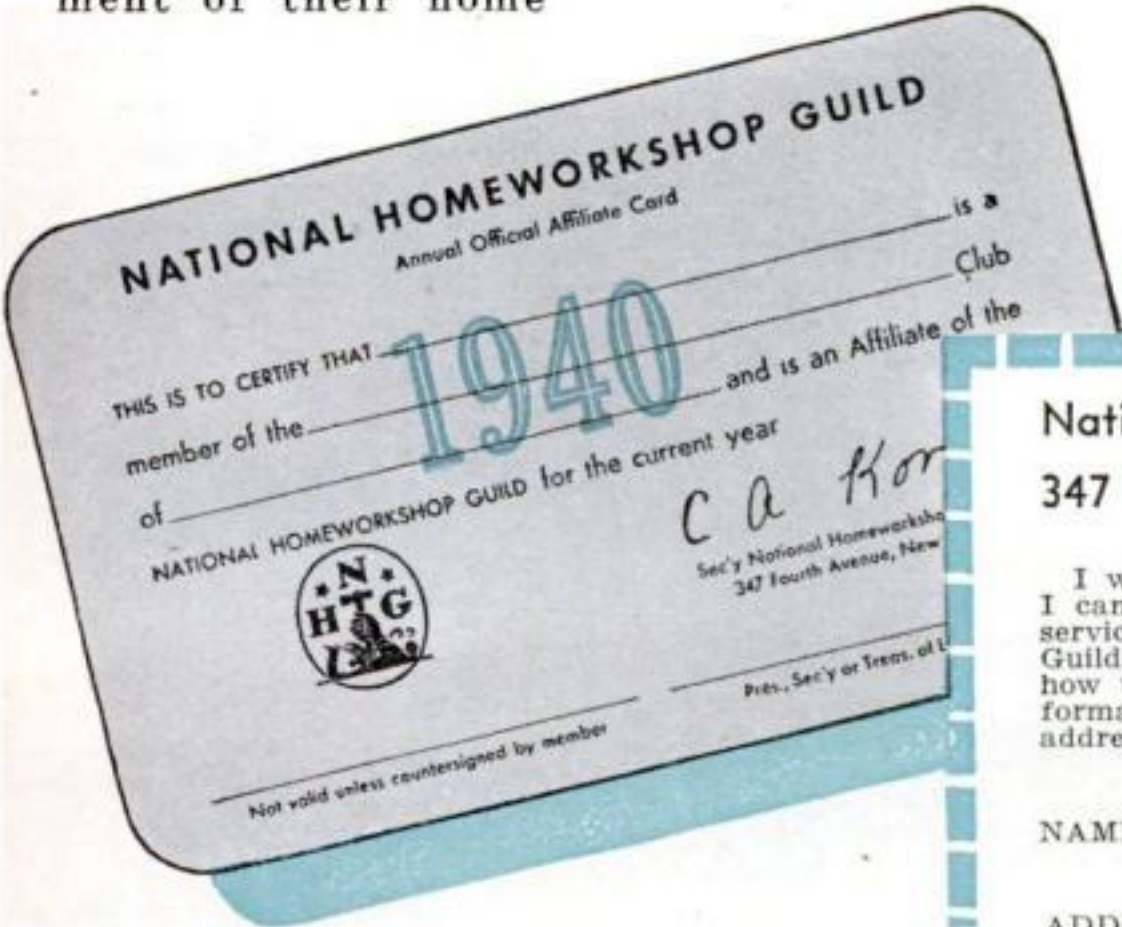


GUILD MEMBERSHIP IS OPEN TO YOU!

Do YOU own one of the cards pictured below? It indicates that the holder is a member of a home workshop club affiliated with the National Homeworkshop Guild. Wide-awake craftsmen everywhere have come to realize that the enjoyment of their home

workshops increases greatly when they meet with others interested in the same hobby. Mutual shop problems are discussed, demonstrations and talks given, and industrial moving pictures shown.

The Guild was formed for the purpose of helping craftsmen get together, and all its services are free. Complete information on how to start a club in your neighborhood and an application blank for a free charter will be sent without charge.



National Homeworkshop Guild
347 Fourth Avenue, New York

I want to start a home workshop club so that I can enjoy its fellowship and receive the many services furnished by the National Homeworkshop Guild. Please send me your special bulletin telling how to do this. For your use in mailing the information, I am inclosing a large (legal size), self-addressed, stamped envelope.

NAME

ADDRESS

CITY..... STATE.....
(Please print very clearly)

Every craftsman should own a Guild card. Use the coupon at right to learn how you can start a club

Hand Tools for

... WOODWORKING,

Using a scraper plane. Near it is a so-called hook scraper; also an ordinary iron scraper



THERE are many tools displayed in hardware stores besides those named in the previous home workshop list. Aren't some of them useful to the home mechanic?

Many special tools are helpful in certain types of work. This is particularly true if no machines, or only one or two, are to be added to the equipment.

What extra planes might be handy?

An adjustable plow is desirable. This tool has several cutters of different sizes and shapes, and will cut grooves, rabbets, beads, and tongue-and-groove combinations. It could replace the ordinary rabbet plane. The universal plane, of similar construction, has many cutting bits and is capable of making almost any straight molding. There are also various patterns of small rabbet planes that will work very accurately close to corners or with the grain of the wood. The carriage rabbet is built like a jack plane, except that the cutter is full width. It is good for heavy work, larger surfaces, and cross-grain cutting.

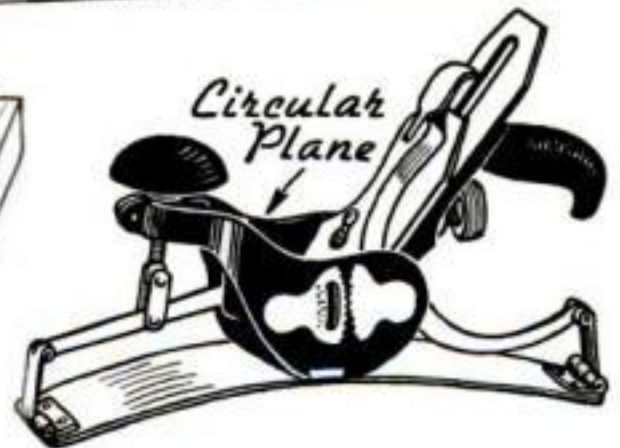
What is an edge or chisel plane?

This is a tool seldom seen, but deserving of wider use. The bit is placed in front, making it possible to plane into the very corners inside boxes or chests. It is also useful for such jobs as dressing the top of a door that binds.

Cabinet Maker's Edge



Circular Plane



Above, grooving a board with a combination plane. Right, three other planes designed for special work

Router



Special Purposes

DECORATIVE METAL WORKING, AND FORGING

What is a router?

This is a flat plane with a chisel-bit, adjustable for depth. It is used for trimming the bottoms of dados to a uniform depth.

Of what use is a scrub plane?

It is a narrow plane with a single, round-nosed cutter and wide throat, used for roughing off excess stock. A similar tool, the furring plane, has a double-arched sole that permits fuzz and grit to fall out.

Are there any other planes of interest?

There are many forms of scraper planes and holders, also the circular plane, having a thin bottom that can be sprung to fit a curve worked on, such as the top of an arched door, or for smoothing the head jamb in the arch.

Why not substitute one adjustable auger bit for several solid bits?

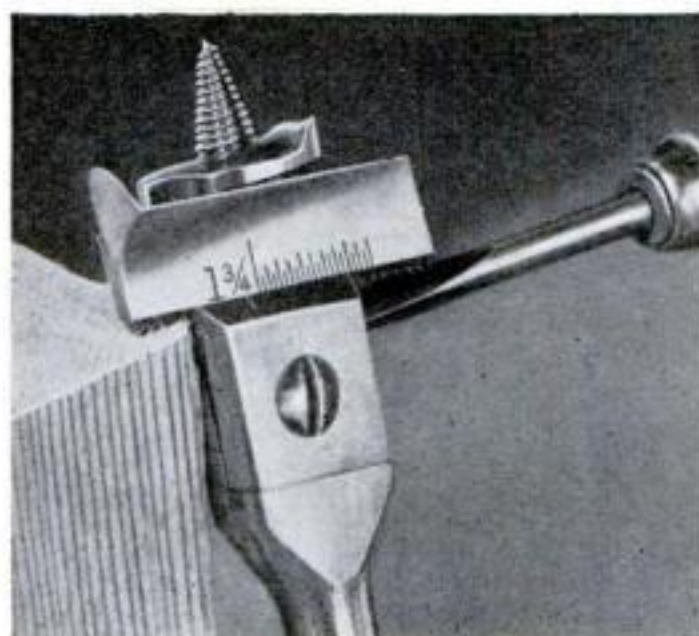
Convenience counts here. The expansive bit must be adjusted for size; and to insure accuracy, it must be tested on a waste piece of wood, so that a little time is lost. Two or three bits of commonly used sizes can be



OUR \$15-a-month budget workshop has now reached a more complete stage. The tool cabinet is finished and hangs above the homemade bench. A varied collection of well-chosen hand tools is neatly racked up for convenient use. Although not visible in this photograph, drawers have also been installed in the bench, and Mr. Love's young friend, Robert Jaacks, will be able to keep his shop orderly from the first. Here he is using an auger bit with a depth gauge, which is shown larger in the insert

PART III OF A NEW SERIES FOR BEGINNERS

By
Edwin M.
Love



A scrub plane with cutter and cap iron. At left, setting expansive bit



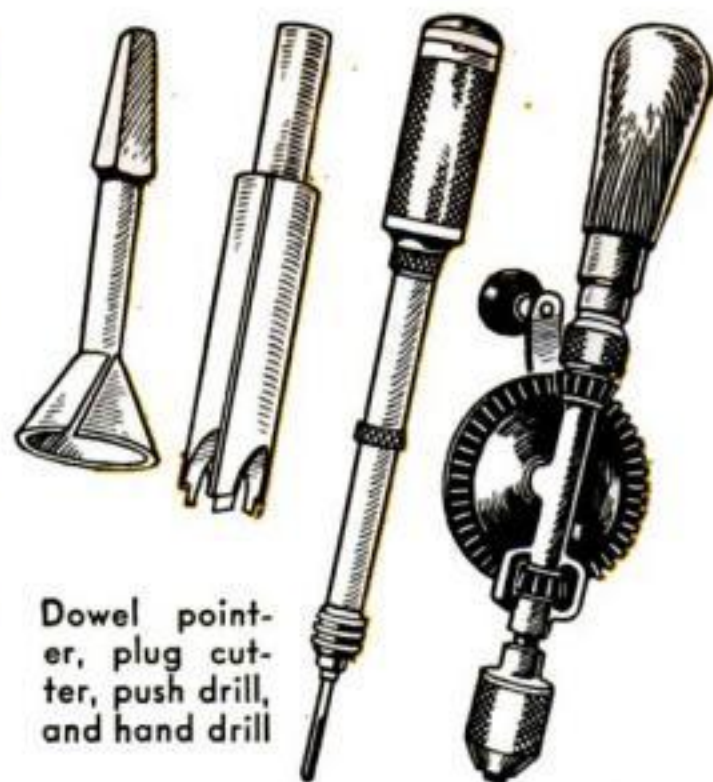
A wooden miter box, carefully used, gives good service for a time, but a metal one, right, is infinitely better

bought for the price of one expansive. On the other hand, for boring holes larger than 1" in diameter, an expansive bit is convenient, as large auger bits are costly.

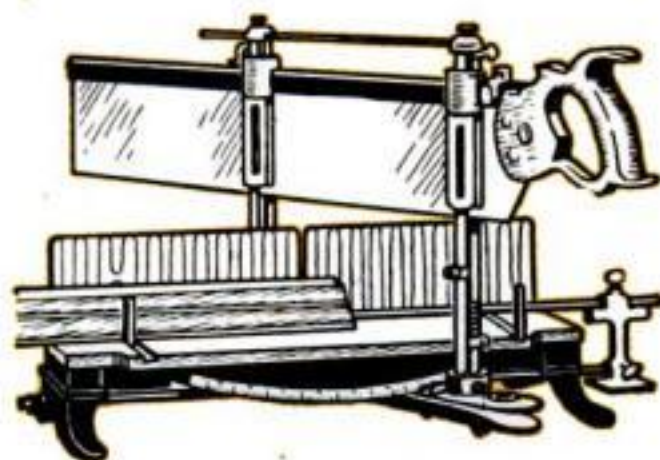
Couldn't a breast drill double for a hand drill?

If much metal drilling is to be done, this is

For wrought-iron work the primary need is a forge. Several essential tools are shown; others can be made



Dowel pointer, plug cutter, push drill, and hand drill



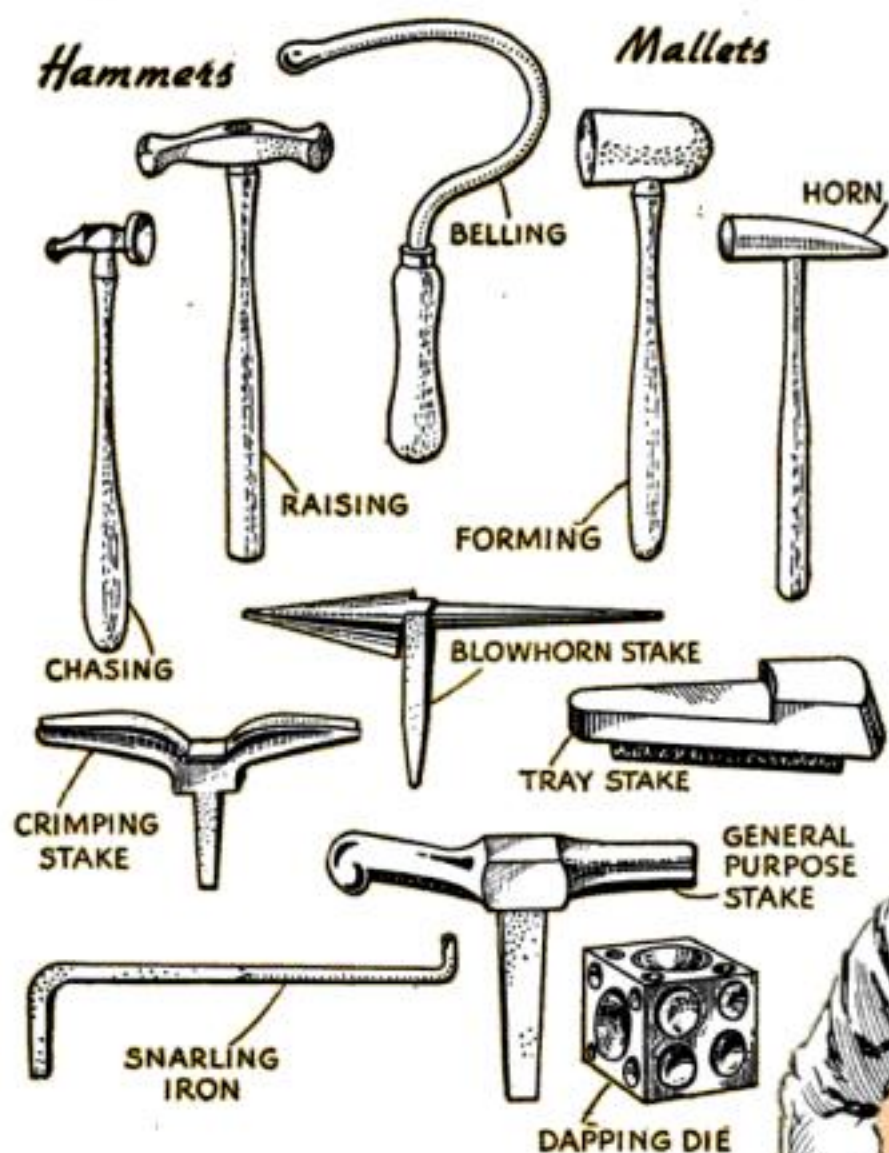
a good idea. A light hand drill, though, is convenient for boring holes for drawer-pull bolts and the like because it can be held back to prevent splitting of the wood inside when the point goes through. For this reason, too, the hand drill is preferable for most wood drilling, although the push drill, which can be used with one hand, certainly has its place.

What are plug cutters and dowel pointers?

The plug cutter cuts a disk of wood to plug a hole that a screw head has been sunk into. If the grain of the wood is matched, such a plug, even on work with a stained or natural finish, can hardly be seen. The dowel pointer chamfers dowel ends so that they will enter dowel holes easily.

Should a home shop have a miter box?

A miter box is indispensable for cutting moldings to go around cabinets, for picture frames, and similar jobs. A wooden box will serve quite well, but becomes inaccurate with use, as the guides wear. There are fairly inexpensive



Chasing, raising, belling hammers; rawhide and horn mallets; various stakes; snarling iron; dapping die

miter boxes on the market for use with ordinary saws. The best, however, are fitted with their own wide back saws, and have locking adjustments for cutting any angle, as well as depth gauges and attachments for duplicating lengths.

What tools are needed for craftwork in sheet metal?

The list is rather short, considering the variety of work that can be done. For simple

flat work, etched or plain, such as fobs, tags, and paper knives, the following will serve: Small cold chisel; machinist's ball-peen hammer, $\frac{3}{4}$ lb.; tin snips, 10". For saw piercing, chasing, and bending: Chasing, forming, neck, and planishing hammers; hand drill with drills; jeweler's saw frame with blades; center, chasing, and dapping punches, the latter with die; leather or canvas sandbag; stake; tin-smith's blow horn, 14 lb. For beating down, fluting, modeling, raising, and necking: Wire polishing brush; belling hammer; horn and wooden mallets; snarling iron; bottom and tee stakes. A blow-pipe for use with gas, and a bellows for draft are also needed, although a blowtorch can sometimes be used. Various hardwood blocks for anvils, and crocks for the cleaning acid (pickle) are required.

What is needed for forging?

The primary need is the forge. One catalogue lists a forge with an 18" hearth, complete with blower, at about \$7. If a motor were at hand, the blower

could be adapted for power. A 70-lb. cast-iron anvil costs about \$5.50. Necessary tools are as follows: Cold and hot chisels with handles; anvil hardy, about 1 $\frac{1}{2}$ "; flatter, 2 $\frac{1}{2}$ " face; fuller, top; blacksmith's cross-peen hammer, 2 lb.; sledge, 8 lb.; punch; two or three sizes of swages; straight-lip and hollow-lip tongs.

(TO BE CONTINUED)

Electric Winder Turns Hand-Loom Bobbins



Bobbins for a hand loom are quickly wound on this inexpensive machine

MANY who do hand weaving find that bobbin winding is a very tedious operation. An electric winder can easily be made, however, from a small polishing head costing less than a dollar, a steel or hardwood spindle turned as shown in the detail drawing above, a piece of $\frac{1}{2}$ " steel shaft 4" long to use in the polishing head, and a $\frac{1}{2}$ " coupling for connecting the spindle and the shaft. These are assembled and belted to a small motor, such as a sewing machine or fan motor. The bobbin is slipped on the spindle, the yarn given one or two turns around the bobbin, and the motor started with one hand while the other hand guides the yarn.—JOHN H. CLAYTON.



Acetic Acid Solution Cleans Water Filter

IF THE "no splash" filter on the water faucet no longer delivers an even stream of water, this may be due to a clogging of the screen mesh with calcium and other salts from the water. To clean, cork one end of the filter and fill it with weak acetic acid (or strong vinegar) and let it stand for ten or fifteen minutes.

Fiber Washers Cut from Fuses

DISCARDED cartridge fuses having fiber cases are a source of fiber bushings and washers. Remove the metal ends, cut the fiber with a hack saw, and smooth the cut surfaces with a file.



Umbrella Rib and Board Aid in Ice Fishing

THIS extra-sensitive ice-fishing outfit, which is especially good for perch, consists of a board with a small cleat, an umbrella rib, a staple, and two small brads. A loop is tied in the line and slipped over the beaded end of the umbrella rib. Being hinged on the staple, the umbrella rib folds back for carrying.—RALPH E. TILLBERG.

Inner Soles for Work Shoes

EXCELLENT inner soles for work shoes may be cut from a discarded wool-velvet rug.—HENRY A. HANSON.

POWER-TOOL SPEEDS

[WOODWORKING]

Machine	Process or type	Suitable r.p.m.	Remarks
Lathe	roughing	800	For stock about 4" thick. Use slower speed for larger diameters
	general cutting	1,800	
	finishing	2,400	
Circular Saw	6" dia.	4,800	
	7" dia.	4,500	
	8" dia.	4,000	
	10" dia.	3,600	
Band Saw	10" dia.	800	
	12" dia.	700	
	14" dia.	600	
Jig Saw	fine blades	600 to 1,750	Down and up constitutes one stroke
	coarse blades	150 to 1,300	
Drill press	boring ($\frac{3}{4}$ " bit)	1,800 to 3,000	Bit size, type of wood, hole depth, etc., govern speed
	boring (multiple spur)	600	
	mortising	2,250 to 3,000	Use 7,000 to 8,000 if possible
	shaping and routing	max. speed available	
Jointer	sanding	1,200 to 1,500	With 3" drum
	ball bearing	3,600 to 7,000	
		8,000	
Shaper			

Note: These speeds are generally recognized as standard for home workshop machines. However, always abide by the manufacturer's directions and, in case of doubt, consult the manufacturer. It is dangerous to operate a machine at a greater speed than that for which it was designed.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

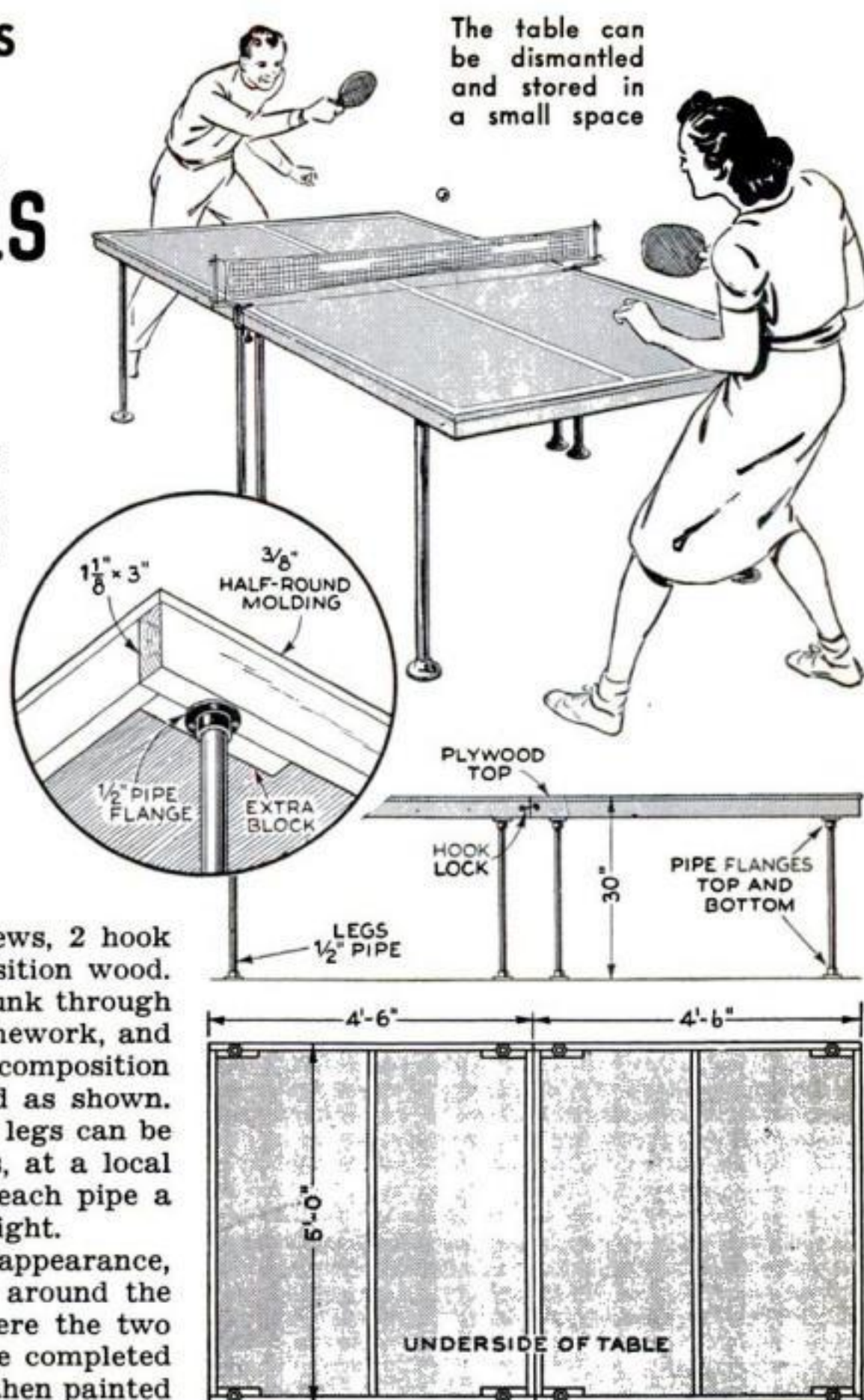
EIGHT PIPE LEGS SUPPORT Table-Tennis Table

A TABLE-TENNIS table that takes very little room when dismantled may be made with iron pipe legs. It is more stable, yet the expense is only slightly more than for one with wooden legs or horses.

Materials: 2 pc. 3-ply or 5-ply wood 4½' by 5', which is a standard size sold for this purpose; 8 pc. ½" pipe 27" long; 16—½" screw flanges; 48' of 1½" by 3" wood (two by fours may be used, but make the table heavier); 28' of ¾" half-round molding; screws, 2 hook locks, paint, and plastic composition wood.

Screws spaced 8" apart are sunk through the table top into the wood framework, and the holes filled with plastic composition wood. Pipe flanges are mounted as shown. The eight pieces of pipe for the legs can be obtained, threaded at both ends, at a local plumbing shop. At one end of each pipe a flange is placed and drawn up tight.

To give the table a better appearance, half-round molding is fastened around the edge but not in the middle where the two halves are hooked together. The completed table is given a coat of shellac, then painted green (with white stripes, if desired). The legs are black.—THOMAS TULLIO.



The table can be dismantled and stored in a small space

Cost of this table is approximately nine dollars

Mounting Reference Sheets on a Bulletin Board

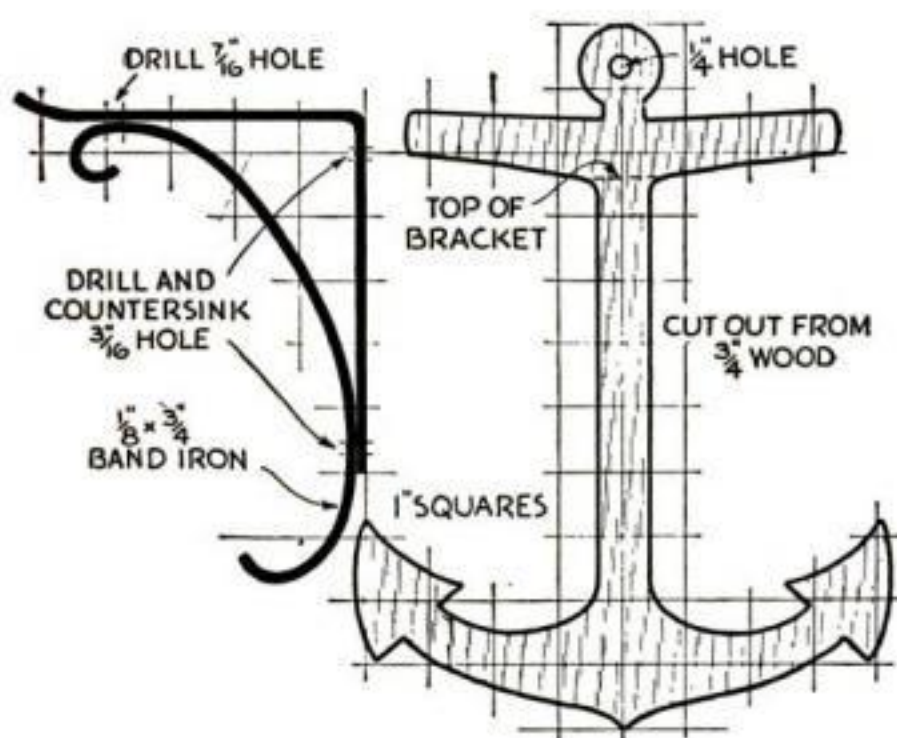


SHEETS of drawings and shop data are often protected in celluloid envelopes. When this is done, a good way of mounting the sheets for ready reference on the shop bulletin board is to use ring backs salvaged from old loose-leaf notebooks. These are mounted on the wall as shown. A sheet-metal shelf under the lower edges of the pages keeps them from sagging. Suitable envelopes can be made by binding together two sheets of celluloid with cellulose tape at the top, fore-edge, and bottom. The back edge, which is punched for the notebook rings, is left open for inserting and removing the various papers.—R. W. WAGNER.

Anchor-Shaped Lamp Hangs Up Anywhere



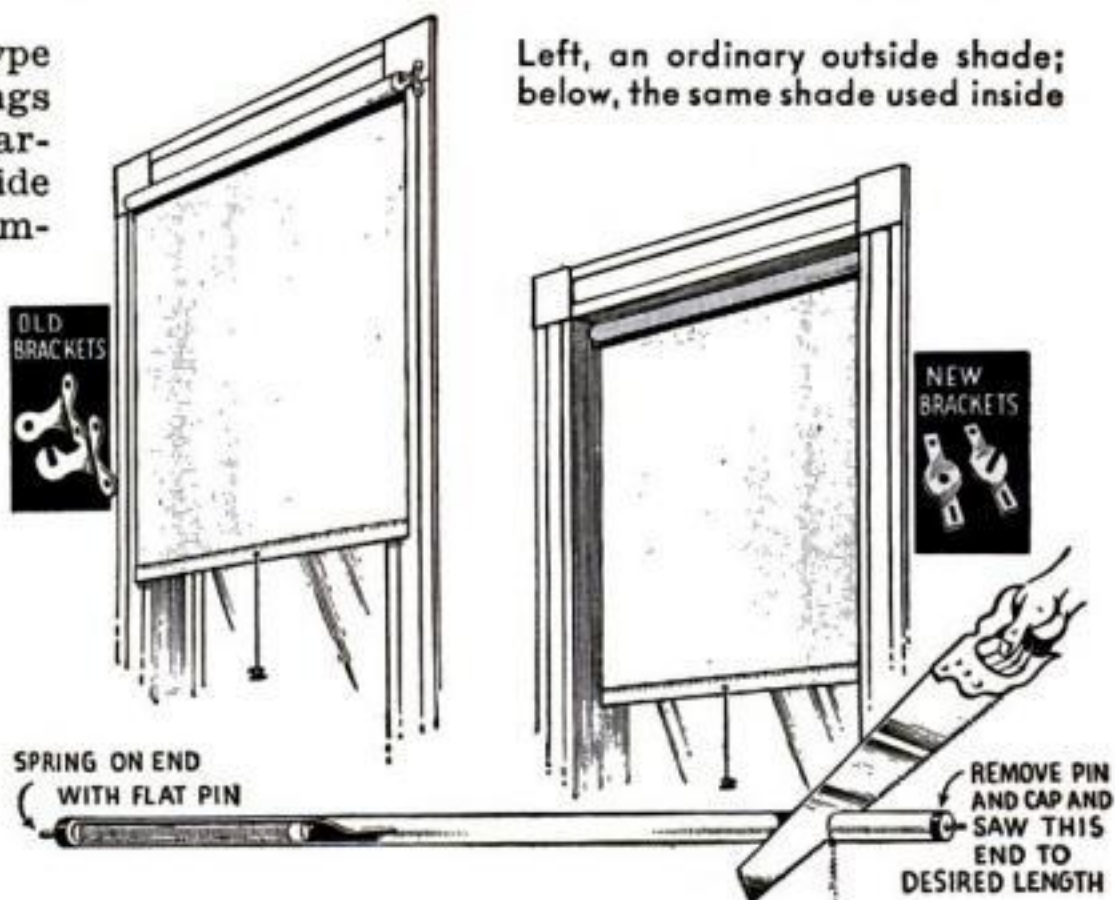
Usually the lamp cord of a pin-up fixture is hard to justify, but here it represents the anchor cable



THIS anchor-shaped lighting fixture is easy to make and may be hung on the wall at any place near an electric outlet. The anchor is scroll-sawed from $\frac{3}{4}$ " wood of almost any common variety that will not readily warp. The two sections of the bracket are bent from $\frac{3}{4}$ " by $\frac{1}{8}$ " band iron, or from 12-gauge brass, if preferred. Drill and countersink the holes as indicated and fasten the metal bracket to the wooden anchor with flathead brass screws. Paint the whole with a gold lacquer of the variety used in bronzing house radiators, or finish in any way desired. Attach a light socket to the bracket with a short section of electrician's threaded pipe and a hexagon nut, and wire with a cord of the desired length.

How to Change Outside Window Shades to Inside

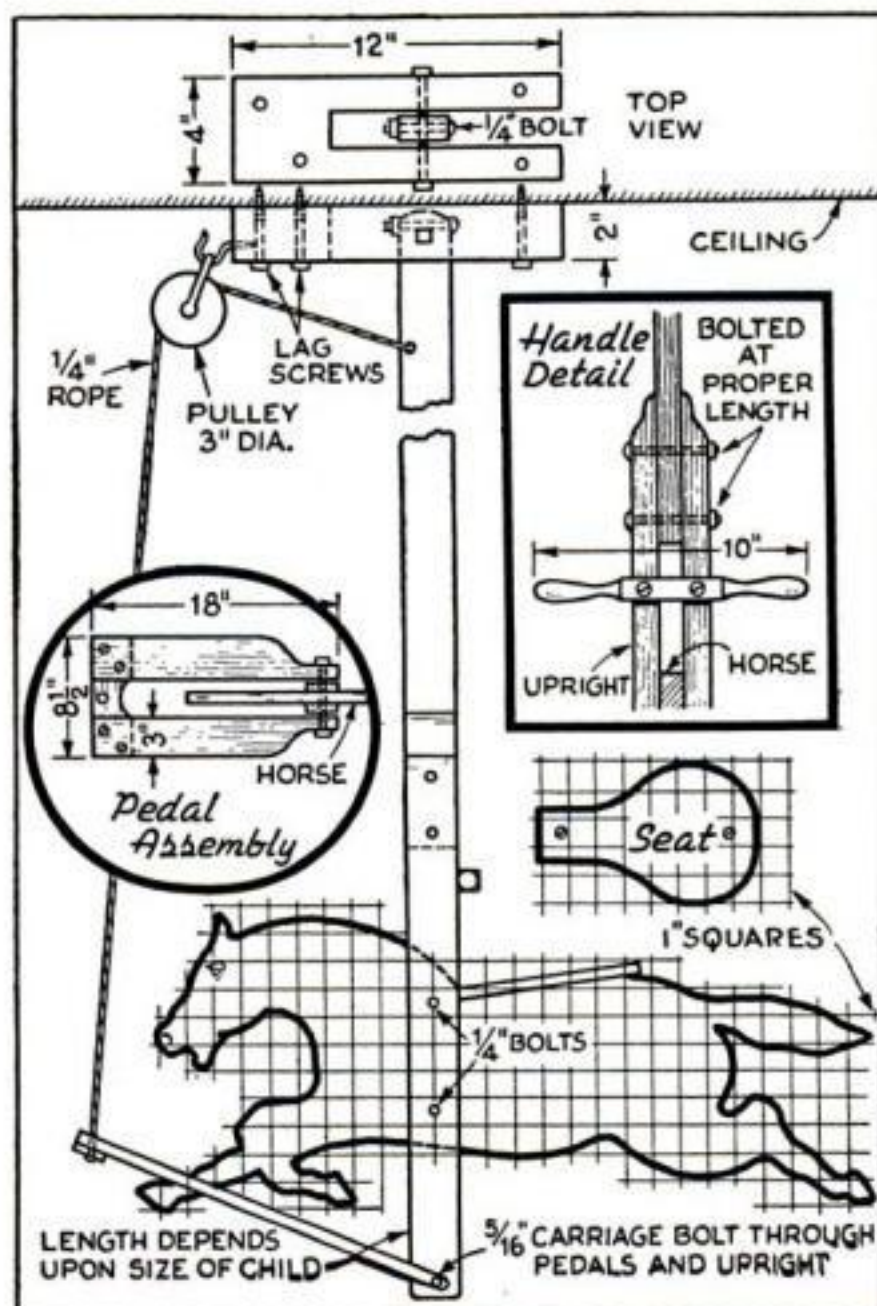
ORDINARY window shades of the type that hang outside the window casings can be cut down quite easily into narrower and neater looking "inside shades." First, buy the required number of pairs of inside-shade brackets. Nail them to the inside window stops about 1" from the top. Remove the old shades from their wooden rollers, measure each roller individually to fit between the new brackets, and saw off the end without the spring. Take the cap and pin from the waste piece and replace them on the cut end of each roller. New shades may be purchased for as little as fifteen cents and cut to the width of the rollers. They may be fastened with tacks or tape.—TIMOTHY F. DONOVAN.



Swinging Pony Toy

OPERATED BY PEDALS

PRESSING on the foot pedals keeps this swinging pony in motion. The harder it is pedaled, the higher it will swing. Cut the horse and seat from $\frac{3}{4}$ " stock, preferably hardwood, and sand the edges round. The



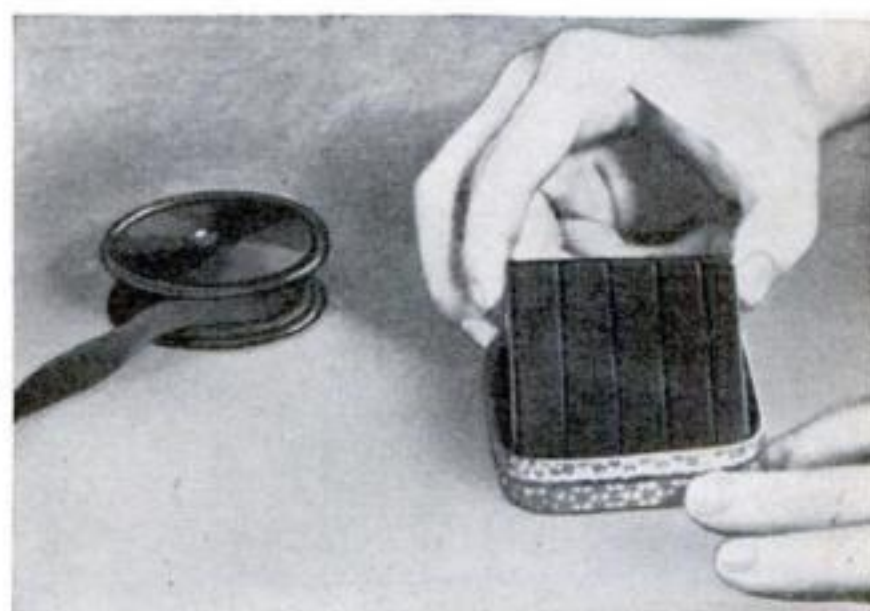
swinging support is made from three pieces of wood, as indicated, with a handle added. In the upper end of the support a $\frac{3}{8}$ " hole is bored for the swing pivot. Just above this hole, bore another in the opposite direction for a $\frac{1}{4}$ " bolt, which acts as a bearing and prevents the pivot bolt from pulling out.

The ceiling support is made from 2" by 4" stock with a slot in it to take the swinging arm. The pedals must be long enough to clear the front legs of the horse. Fasten the rope as shown. When hanging still, the front of the pedals should slope up. The horse may be made larger than in the drawings, if desired.—P. G. LACKEY.

Old Typewriter Ribbon Serves as a Stamp Pad

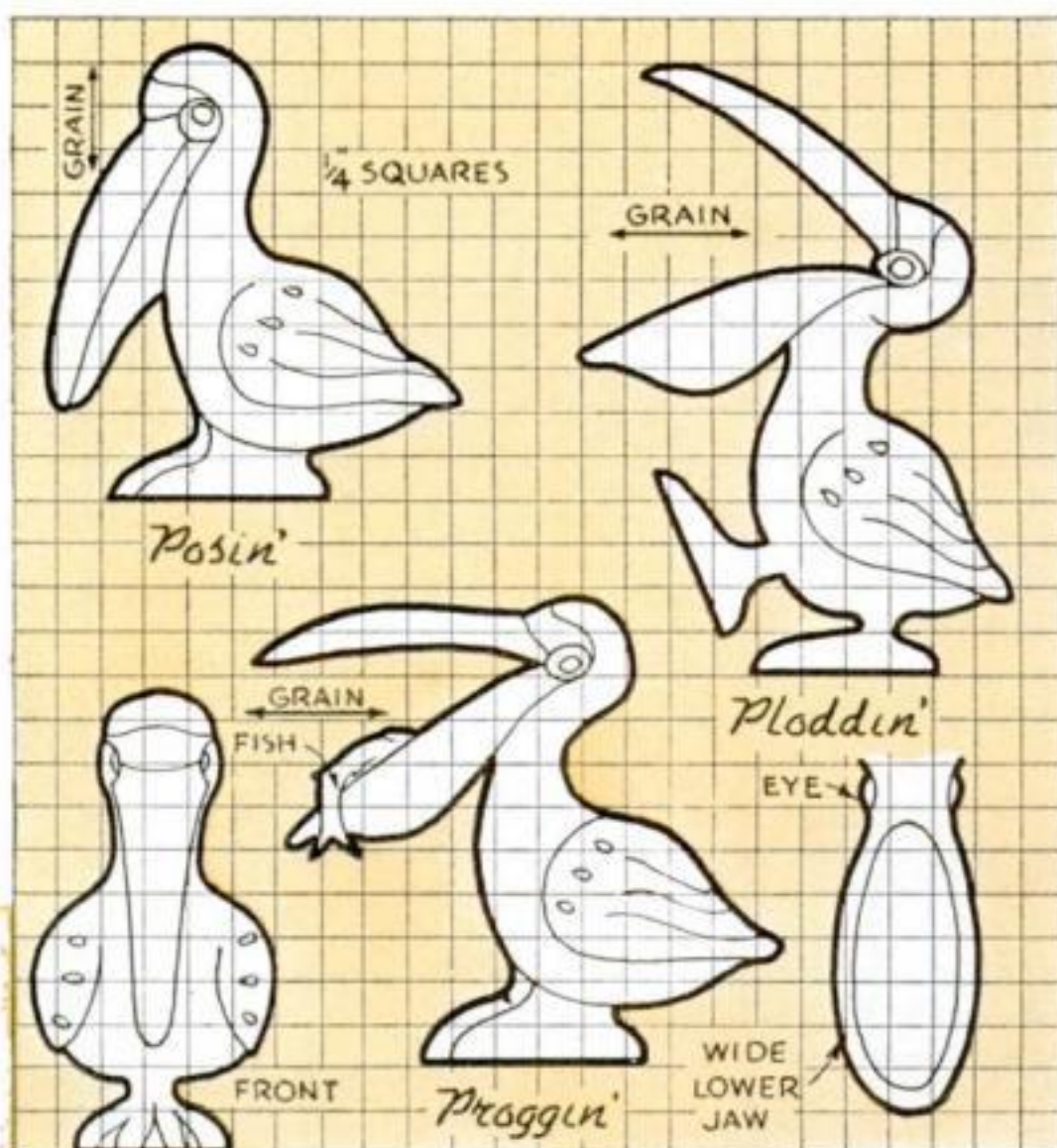
AN OLD typewriter ribbon will serve as a substitute for a rubber-stamp pad in an emergency. Wrap several layers of the ribbon around a stout piece of cardboard cut to fit inside a small tin or cardboard box. When the stamp no longer gives a clear impression, the outer layer of ribbon can be removed to expose the next layer.—W.S.

PRIZES totaling \$100 await those readers who write the best letters telling what appealed to them most in this issue. See "Our Readers Say" Department for details.



Several layers of the old ribbon are wrapped on a piece of cardboard and placed in a suitable box

THREE POSES TO BE CARVED IN WOOD OR SOAP



In the two poses of Pete with his bill open, it is necessary to hollow the bill as indicated in the photos at the left

If carved from soap or from a plastic as at the right, Pete should have a smooth finish



MANY of us can remember at least one expressive line to add to this old doggerel:

A wonderful bird is the pelican,
His beak holds more than his belican.

It was with this in mind that these three poses of Pete the pelican were designed. All are composed of simple lines. For whittling, use 1½" straight-grained white pine or basswood. Saw out the silhouette, cut away extra wood as shown, and round up roughly. Knife marks help rather than detract from the appearance. Hollow the bill when the mouth is

By E. J.
TANGERMAN

open. For the "progin" (or begging) pose, add a whittled fish. Finish by linseed-oiling or painting.

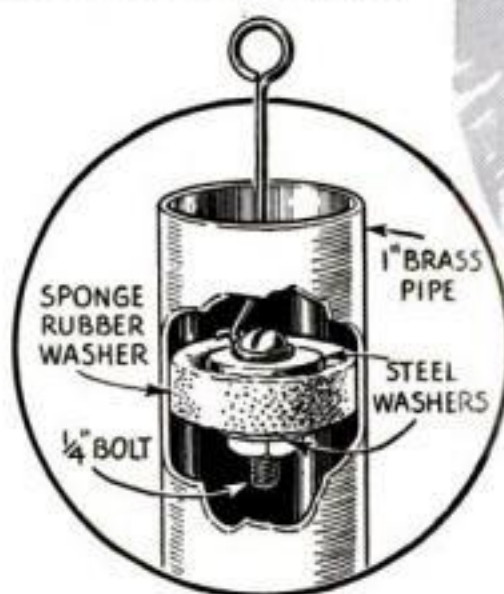
Pete can also be made in soap (or plastic). If you make him of soap and want him colored, use water colors daubed on, or sealing wax dissolved in alcohol.

A Dinner Gong from Brass Pipe

A DINNER gong made from a piece of brass pipe has a rich, full tone that can be heard throughout the house, yet is pleasant to those who happen to be near it. A 3' length of 1" standard brass pipe, 1 5/16" outside diameter, is a good size. Iron pipe will not do. The pipe may be finished in polished brass and lacquered, or it may be nickel or chromium plated. Painting would tend to damp the vibrations.

To support the pipe, cut a 1/2" or 3/4" sponge-rubber washer so that it fits snugly inside the pipe and sandwich it between two iron washers that will drop into the pipe with a clearance of not more than 1/8". Pass a 3/16" or 1/4" bolt through the three. Loop a piece of wire under the head of the bolt or nut and slide the assembly into the pipe to a depth of 4 3/4". With the end of the wire projecting through the end of the pipe, tighten the bolt, thus causing the rubber washer to swell and provide a nonmetallic grip on the inside of the pipe. Of course, when inserting the washer, it should be sufficiently compressed so that it is a tight fit. Suspend the gong by the wire from a hook that is long enough to keep it at least 1" from the wall.

A mallet may be turned from mahogany or walnut. Felt disks glued to its faces improve the quality of tone. The gong should be struck at the top with a sharp, quick stroke, preferably from the side to avoid swinging it against the wall.—W. N. LURCOTT.



The pipe is hung by means of a plug of sponge rubber



Wire Wrapping Improves Light Soldering Iron

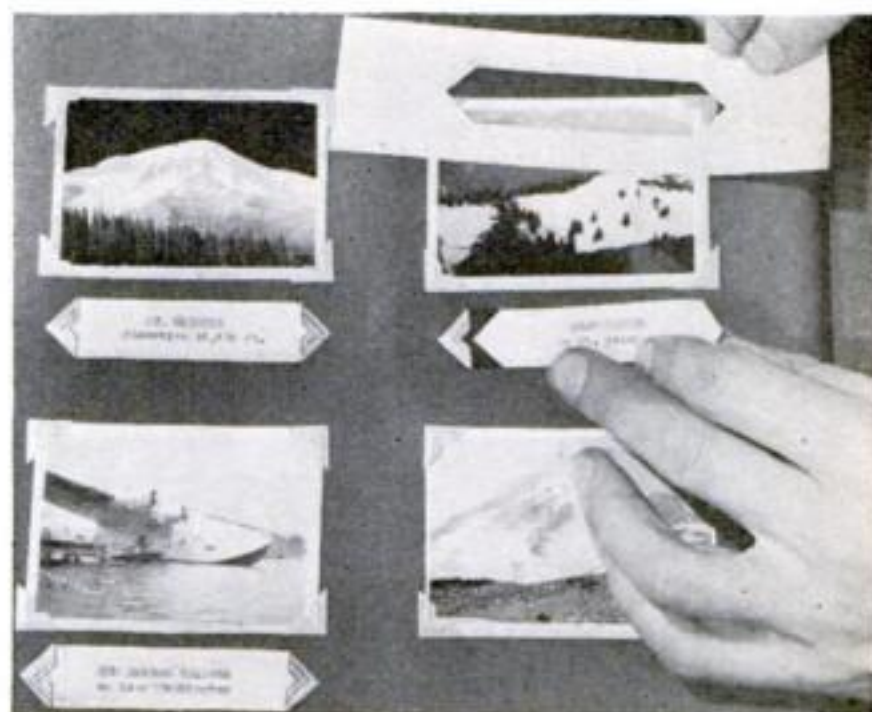
LIGHT-DUTY electric soldering irons will remain hot longer after the current is turned off if a length of bare copper wire, No. 10 or larger, is wrapped tightly around the shell. They will also handle heavier work.

Substitute for Hollow Rivets

DISCHARGED .22 caliber cartridges may be used as hollow rivets for fastening leather work or cardboard together. The short, long, and long-rifle shells give an assortment of lengths. To spread the open end, drive in a center punch.—NORVAL WRIGHT.

Mounting Corners Hold Titles in Photo Album

TITLES for album pictures may be typed on heavy paper and neatly fastened with ordinary photograph-mounting corners. A cardboard mask made as below may be used for outlining each tag with a pencil before cutting it out.—M. G. W.



Titles and template for cutting them. Photo data may be typewritten on the back, if desired

●



The 'Unitwin Vega'

By **DONALD W. CLARK**



This trim model with tricycle landing gear is 12" long and has a wing span of 15 $\frac{3}{4}$ "

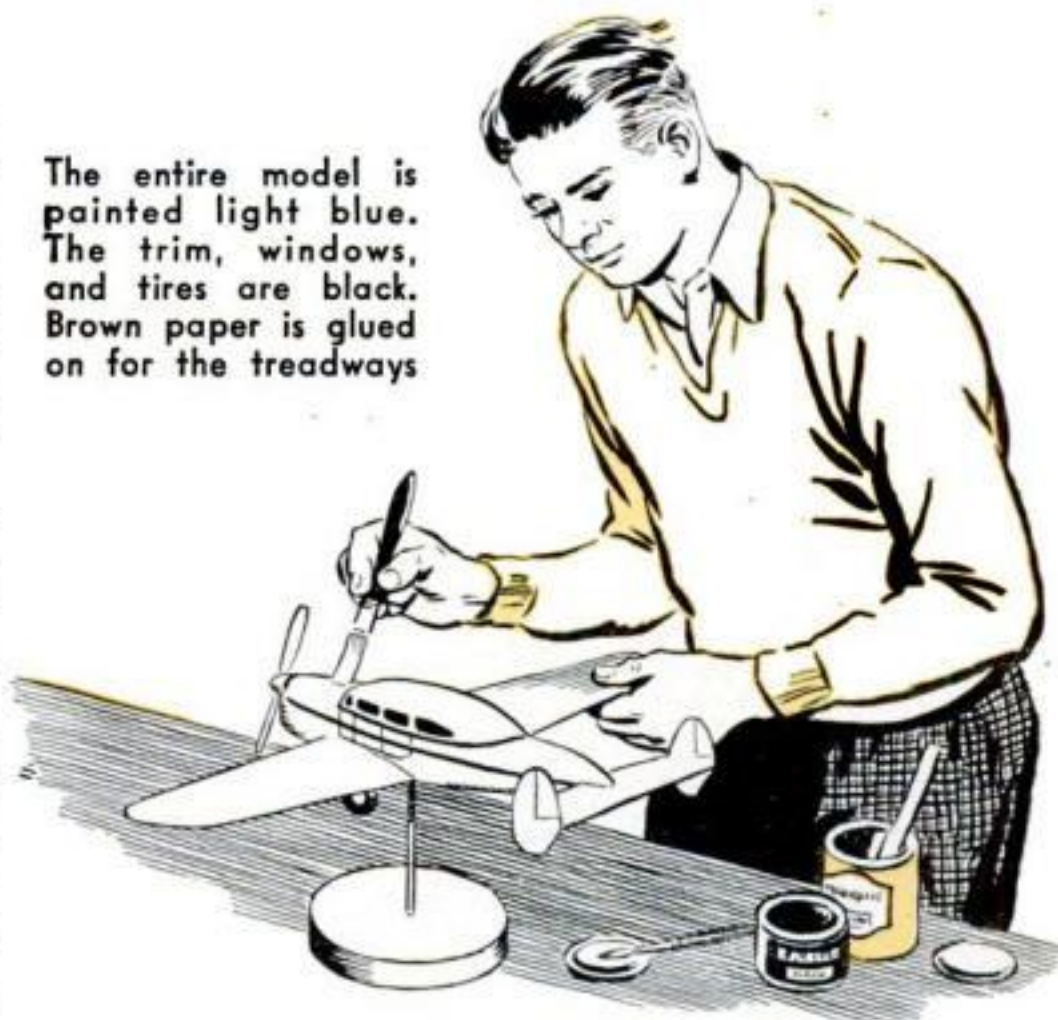
ONE of the most graceful airplanes among the newer designs is the "Unitwin Vega." This beautiful ship is made in two designs, the first a five-place model, the "Custom," and the other a six-place "Starliner" intended for feeder airlines. There is no difference in size, but the "Starliner" has a longer cabin interior and a different seating arrangement from the "Custom," which is the model shown in the drawings.

An unusual feature is the power plant—two inverted Menasco C6S engines rated at 260 h.p. each and mounted side by side. They drive a single propeller shaft through a new method of gearing embodying overrunning clutches. If one engine should fail, the other does not have to work against the inertia of the dead engine. In addition, the failure of one engine does not cause the same tendency to turn out of line as in conventional twin-engine designs.

It is claimed that this ship can take off and climb to 11,000' under full load with only one engine running. On both engines it can climb at an initial rate of 1,400' per minute and maintain a top speed of 210 m.p.h. at 10,000'. The wing span is 41', length 32' 5", height 8' 6", empty weight 3,940 lb., and useful load 1,810 lb.

This $\frac{3}{8}$ "-to-the-foot model is similar to previous models in the series, but like the Grumman fighter, the cabin space is sawed

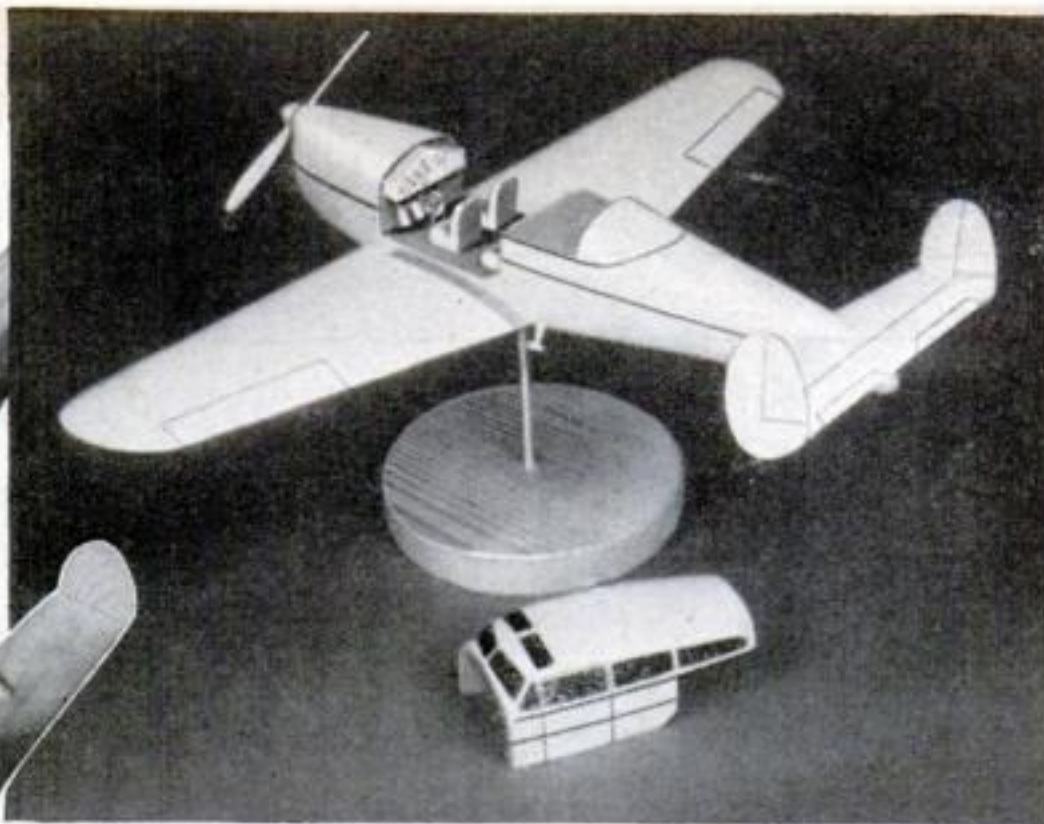
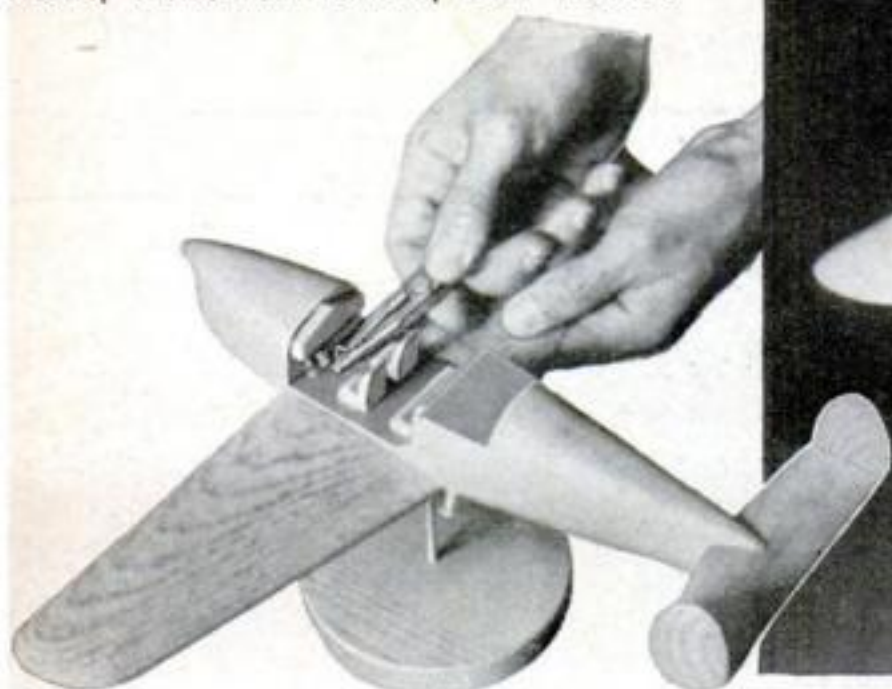
The entire model is painted light blue. The trim, windows, and tires are black. Brown paper is glued on for the treadways



out and carved to fit over the seats. The drawing shows how this can be done in an even more realistic manner than illustrated in the photos, but it is a delicate job to cut out the windows. Instead of making one half removable, you will find it much easier to leave the block in one piece and cut away just enough wood so it will clear the seats and instrument board. In this case your finished model will appear to be a solid one, but lifting off the shell reveals the cabin interior. The instrument board and back of rear seat will keep this cover from shifting out of place.

If soft wood is used for the fuselage, the wheel pockets can be cut in with a razor

A section of the fuselage lifts off to reveal the cabin interior, which contains all essential details such as the seats, instrument board, and controls



blade and dug out with a small chisel. Sugar pine is a good wood to use.

After you have the body completely shaped and smoothed up, mark all the necessary lines according to the drawing and clamp it in a vise, using two pieces of thick cardboard to prevent dents. With a fine-toothed coping saw, carefully saw out the cabin portion as illustrated. The surfaces on the fuselage should be sanded smooth. Next, hold the cover block in a vise and saw deep enough to clear the seats and fittings and leave a $\frac{1}{8}$ " wall. To fill in the saw space, build up the edges with plastic material and when dry, trim and sand to fit.

Where the wheel-strut pins go through

the struts there will be spaces on each side. Fill these with short pieces of tubing, washers, or a gob of cement to keep the wheels centered. A tight fit will keep the wheels in either the raised or lowered position. Glue the wheel mounts to the wings. The metal propeller blades are glued in pockets as indicated.

Make the seats and instrument board of wood; the pedal hangers, control post, and wheel of paper-clip wire, and the foot pedals and instrument-board face of white cardboard. The latter should be marked out with India ink, cut to shape, and glued in place. For the seats, plane pieces to the seat profiles (like a molding), and cut to proper length. Glue the parts together securely.

The entire plane shown in the photographs is painted light blue, and all the trim is black. The windows and tires are blackened with India ink. If the windows are cut out, cover them with thin celluloid or cellulose transparent tissue. The treadways are strips of brown paper glued on the wings.

Well-Boring Outfit Costs Little to Rig Up

IF THE ground is suitable, a well can be bored by one man in a day with the outfit illustrated. The handle is removed from a standard well-digging auger, and a length of old $\frac{3}{4}$ " or heavier pipe is attached. A chain is then looped around the pipe so that it can be raised and lowered with a block and tackle. The auger is turned with a pipe wrench. When the hole has been bored, the well may be cased with terra-cotta pipe and a cement curb constructed around the mouth.—R. R. HARPER.



Sēcrets īn Stōnē

(Continued from page 246)

or three pieces of stone near the slide edges. These are ground down along with the specimen, and are removed before final application of a cover glass.

After the specimen has been made flat and polished on one side, wash the slide and wipe it dry. Then hold it over a flame until you can lift the mica off with tweezers. Turn the specimen, which is still fastened to the mica, over until the polished surface is down, and cement it in the center of the slide, using heated balsam as before. The mica piece, you see, is merely a convenient way of handling the bit of stone without losing or breaking it. Some types of rock material are quite delicate when reduced to fairly thin sections, and the mica makes it possible to handle them safely. You do not have to remove the mica from the specimen after it is turned over, for it grinds away quickly.

Be sure the polished surface of the specimen is flat against the glass. Then grind and polish the second surface. Work carefully, for it is easy to spoil the job by too much grinding. When the bit of rock has been reduced to a thin wafer, you will be able to see light through it, especially if it is a rock that is partially transparent to begin with. Work the piece down until it is very thin, about 1/1,000" being somewhere near right. Use your microscope frequently toward the end of the grinding and polishing operations, to check progress.

Finally, when the section looks thin enough, wash it to remove particles produced by grinding. Dry it, with gentle heat if necessary, and drop some xylol on it. Then apply some Canada balsam and put the cover glass in place. You will find that the addition of balsam and the cover increases the transparency of the section and subdues surface scratches.

In this way you can build up a collection of rock sections. Using the same technique, you can mount coal, peach seeds, cherry stones and other hard, dense materials. When working fruit seeds, a flat file sometimes is quicker than a coarse stone for preliminary operations.

Granite, basalt, and many other kinds of rocks are best examined in polarized light, which produces beautiful colors in the various materials of which they are composed, and shows details of structure that are not visible in ordinary light. Other rocks, such as limestone, show to no particular advantage in polarized light.

HEAR

**EASILY... CLEARLY
ENJOY LIFE FULLY AGAIN!**

You, like thousands, should find new happiness through the Western Electric Audiphone. This product of Bell Telephone research helps users to hear in group conversation, at greater distances. Your dealer will recommend the right Audiphone for you. Service available in all principal cities.

Accepted by Council on Physical Therapy,
American Medical Association.

**Western Electric
HEARING AID**
Ortho-technic Model

GRAYBAR ELECTRIC CO., Graybar Building, New York
Please send details on Western Electric Audiphone (Ortho-technic Model) and name of nearest dealer.

PS-52

Name.....

Address.....

City..... State.....



**VIKING - TWIN
Garden Tractor**

2 Cylinders - 5 H. P.

It Plows, Harrows, Seeds, Cultivates,
Mows, Does Belt Work, Pulls Loads, etc.

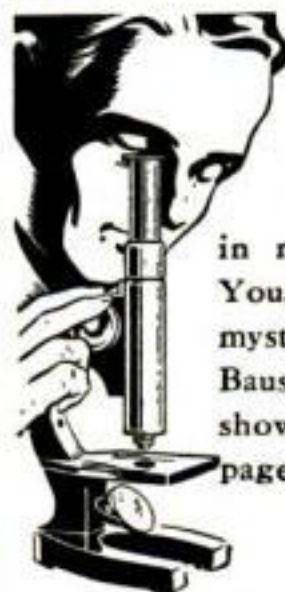
1 Cylinder, 3 1/2 H. P. Models

Write for Complete Catalog

ALLIED MOTORS CORP.

Minneapolis, Minn. New York, N. Y.
3142 E. Henn. Ave. 87-96 West Street

**IT'S THRIFTY TO INSTALL NEW
CHAMPION SPARK
PLUGS**



**MICROSCOPY
IS FUN**

Thousands have found in microscopy the ideal personal hobby. You, too, can learn the secrets of nature's mysterious, unseen world—through a precision Bausch & Lomb Microscope. Model R, as shown, \$21, including walnut case and 455-page book, "Adventures with the Microscope." Other models, \$14.50 up. Send for interesting free booklet.

BAUSCH & LOMB MICROSCOPES
BAUSCH & LOMB, 333 Bausch St., ROCHESTER, N. Y.

Free!
TO SHOP
MEN



New 1940 Catalog of **SOUTH BEND LATHES**



THIS new 48-page catalog describes the 1940 line of South Bend 9-inch Workshop Lathes. Twenty-three different models are listed at prices ranging from \$115.00 up, complete with drive equipment.

Improved engineering features of the new 1940 model lathes include quick change gear equipment making all power feeds and threads instantly available at the touch of a lever and an automatic apron with friction clutch drive for power cross feeds and power longitudinal feeds.

Attachments, chucks and tools for production manufacturing, precision tool room work, general machine work and automotive service machine work are also listed in this catalog.

SOUTH BEND LATHE WORKS, 843 E. Madison St., South Bend, Ind., U.S.A.

WRITE FOR YOUR COPY TODAY

SOUTH BEND LATHE WORKS
843 E. Madison St., South Bend, Ind., U.S.A.
Please send me Free your New 1940 Catalog of South Bend Lathes.

Size of Lathe _____
Name _____
Address _____
City _____ State _____

A copy of this new 9-inch Workshop Lathe Catalog will be mailed on request. Use the Coupon or a post card. State size of lathe best suited to your work.



6 SIZES OF SOUTH BEND LATHES

Manufactured in 9", 10", 11", 13", 14½" and 16" swing, in 3' to 12' bed lengths. Motor Drive or Counter-shaft Drive, Quick Change Gear or Standard Change Gear type.

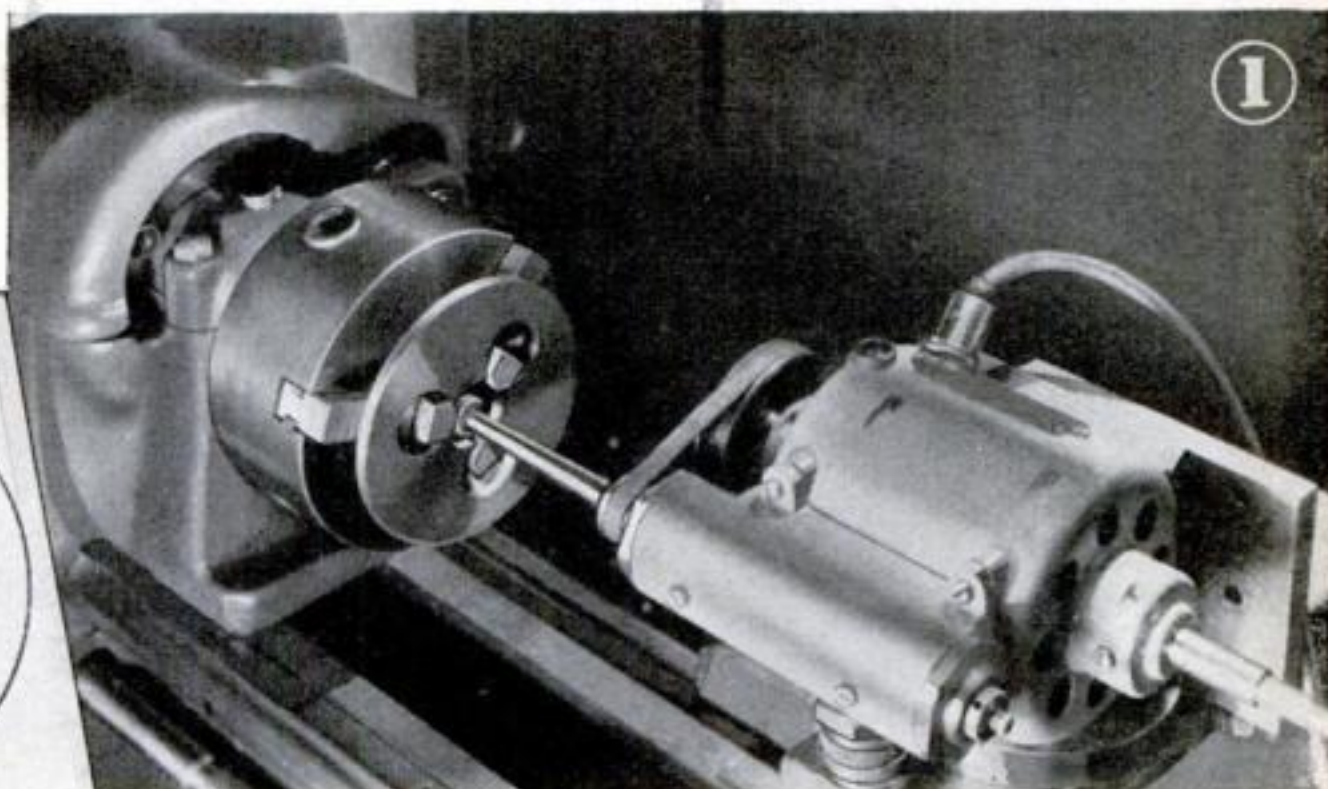
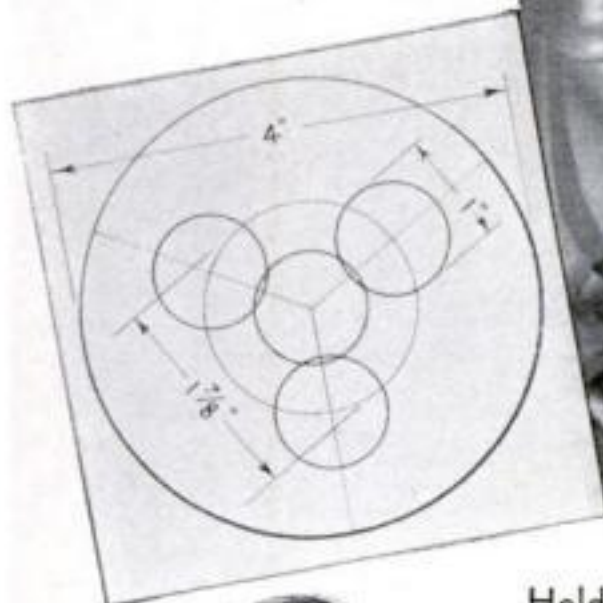
SOUTH BEND *Precision* **LATHES**



new SHOP IDEAS

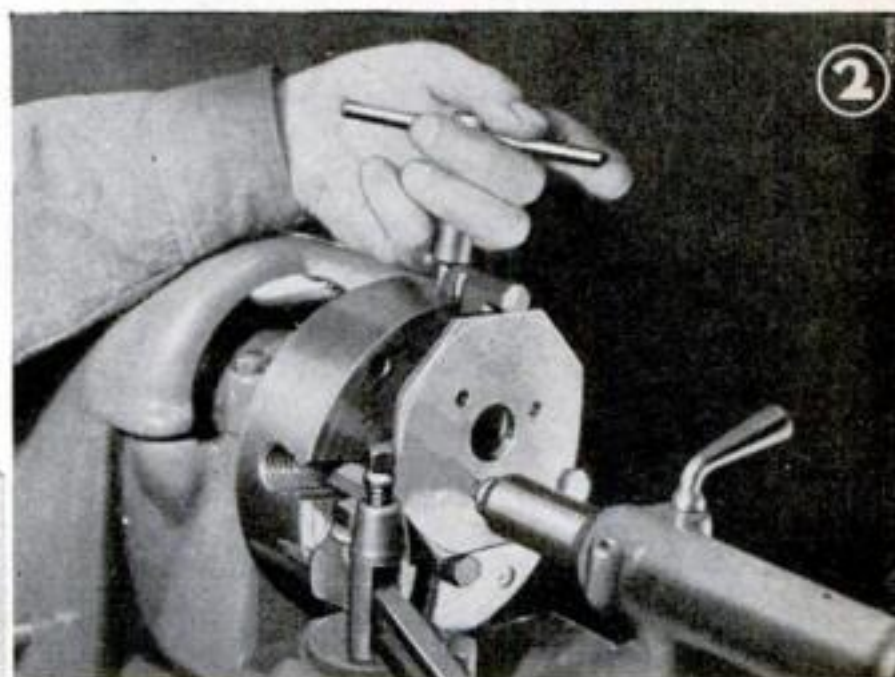


The disk shown below puts a strain on the chuck jaws and holds them open for grinding



1

Held with the disk, the jaws are ground as in Fig. 1. The method of centering the holes in the disk is shown in Fig. 2. The holes are then bored out to exactly 1" in diameter as illustrated below



2

AIDS IN TRUING A Lathe Chuck

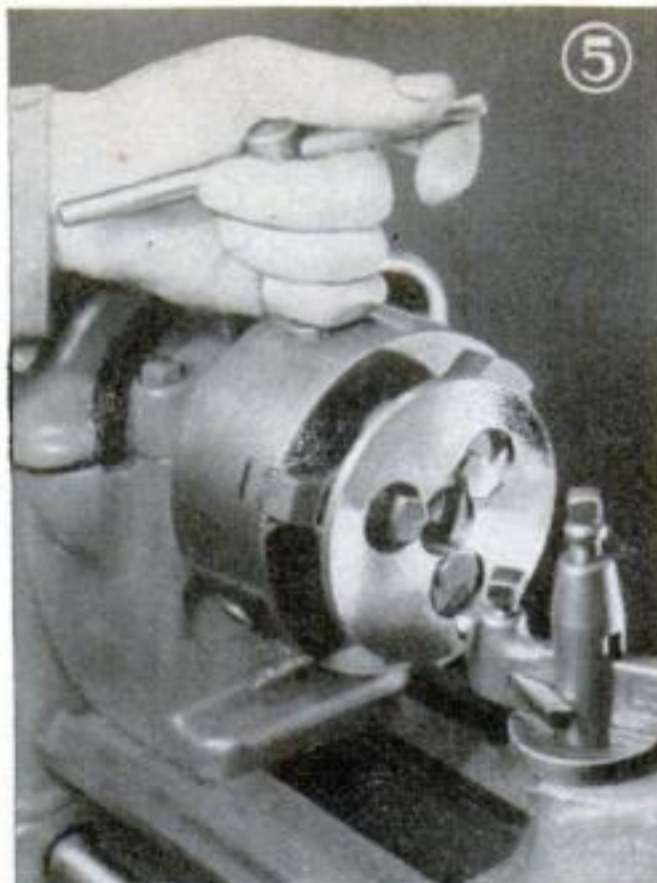
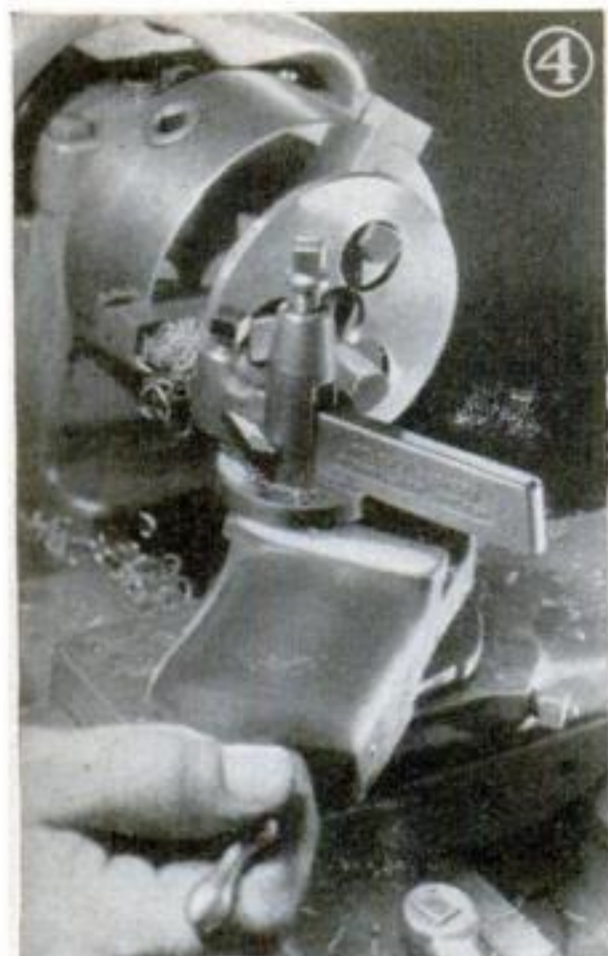
By
CHESTER WARREN WOODSON

WHEN the three-jaw chuck of your lathe no longer turns dead true or the jaws become bell-mouthed and therefore grip long bar stock with the back of the jaws only, it is a simple matter to make up the accessories required for grinding the jaws flat and true. This will restore the chuck to its original accuracy and eliminate the annoyance and delay always caused by

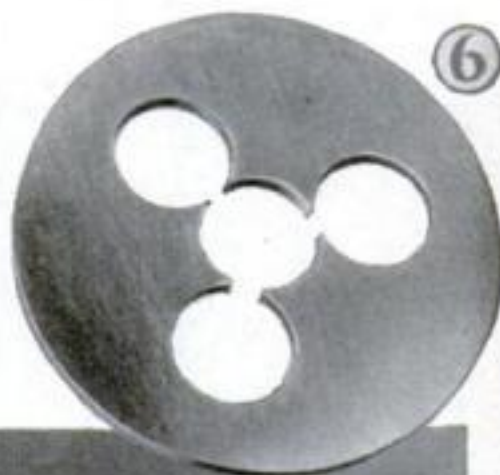
attempting to work with imperfect tools.

The general set-up for grinding the jaws is shown in Fig. 1. First, however, it is necessary to make a device to hold the jaws open for grinding. This is illustrated in Fig. 6. A 4" disk is cut from cold-rolled steel about $\frac{1}{4}$ " thick and bored to the dimensions given in the drawing. This size will fit the average small chuck, but the dimensions can, of course, be changed as necessary.

After the holes have been accurately laid



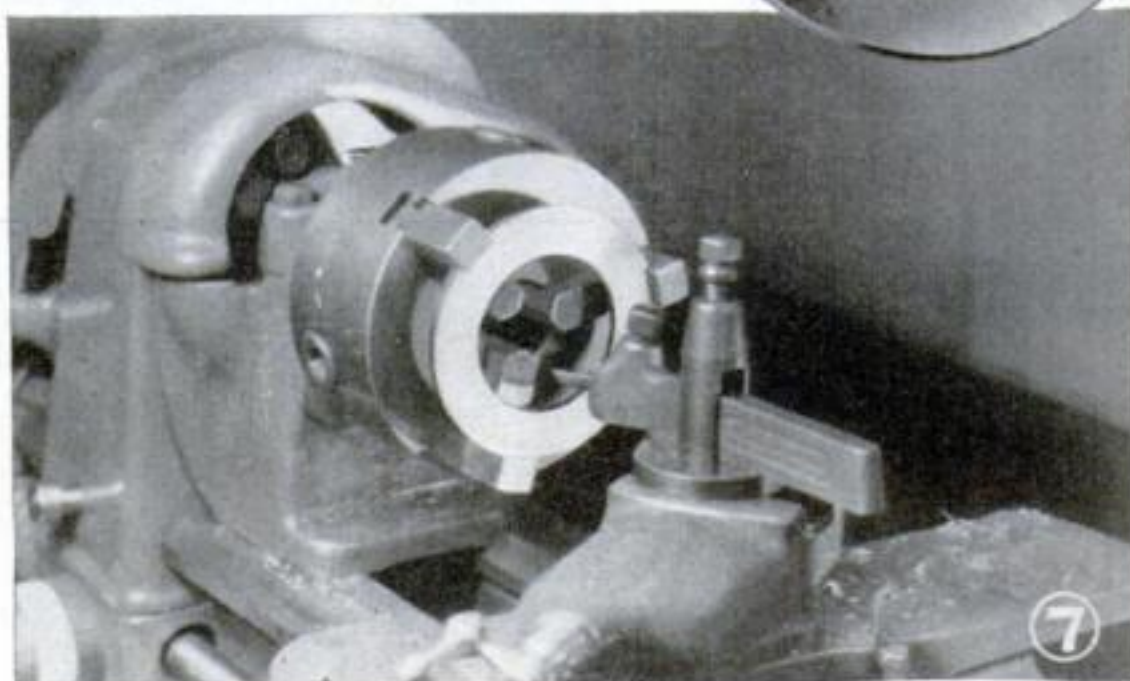
After the disk has been bored, it can be held in the three-jaw chuck while its edge is turned smooth as in Fig. 4. Then the chuck jaws are tightened on it as in Fig. 5 for the grinding operation. The finished disk appears below



out and drilled $\frac{1}{4}$ " in diameter, the stock for the disk is placed in a four-jaw chuck and each hole centered accurately. The work is held in position with the tailstock dead center while the chuck jaws are carefully adjusted as in Fig. 2. Each hole, after being indicated true, is then bored out to exactly 1" in diameter as shown in Fig. 3. Once the holes are bored, the disk can be held in the three-jaw chuck (Fig. 4) while its edge is turned smooth.

Figure 5 shows the disk in position and the chuck jaws being tightened. This puts a strain on the jaws exactly as if they were in use; at the same time the jaws are held open, exposing their tapered edges to the grinding wheel (Fig. 1).

The lathe is started and run at medium speed. As the chuck revolves, the grinder is adjusted to take a very light cut and is



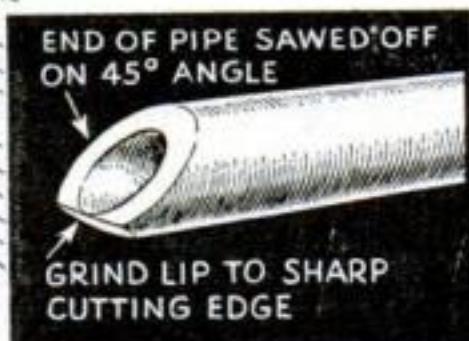
To hold the set of external chuck jaws for grinding, it is necessary merely to turn a simple steel ring of suitable dimensions

fed slowly into the open chuck for the full depth of the jaws. No more stock should be ground away from the jaws than is absolutely necessary.

A simple steel ring, as illustrated above in Fig. 7, is all that it is necessary to make in order to true up the external set of chuck jaws.

Sharpened Pipe Quickly Cuts Hole in Brick Wall

After each blow the drill is turned slightly

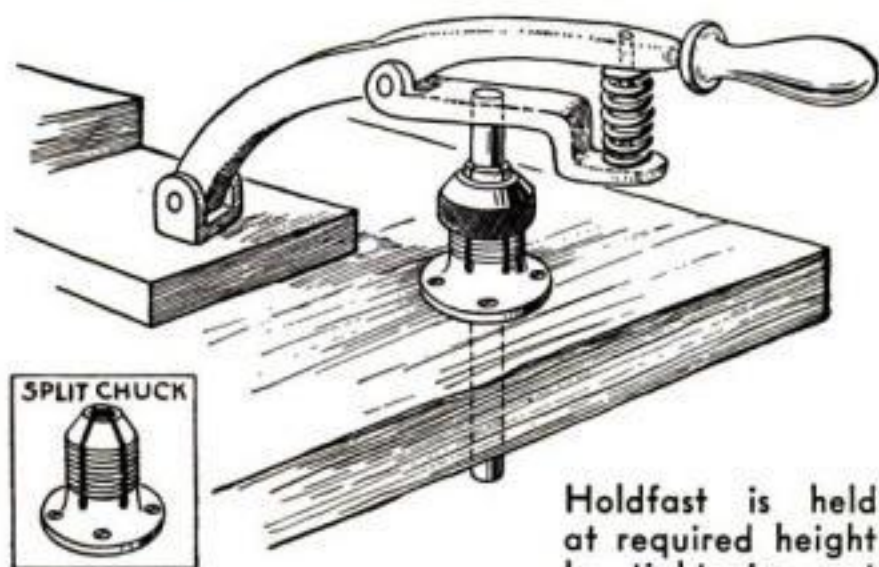


TO CUT holes through brick walls by hand, a drill can be made by sawing a piece of pipe on a 45-deg. angle, then sharpening it on a grinding wheel or with a flat file as illustrated. Give this pipe drill about one sixth of a turn between each blow of the hammer. This tool has proved superior in endurance to the old-style notched-tooth pipe drill and also more efficient, especially for holes of $\frac{1}{2}$ ", $\frac{3}{4}$ ", and 1" in diameter. That is because the cutting edge is broad and supported by more metal backing.



Hack-Saw Blade Mounted for Extra Heavy Work

FOR sawing tanks and other heavy materials where a hack-saw frame cannot follow the blade, a blade may be attached to an old or cheap handsaw. One end is brazed to the point of the handsaw, and the other end clamped as shown. First, however, the set of the teeth on the handsaw is removed by light hammering or grinding.



Holdfast is held at required height by tightening nut

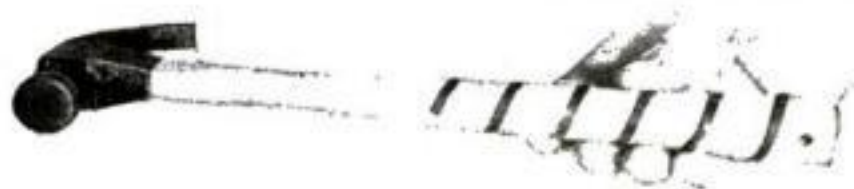
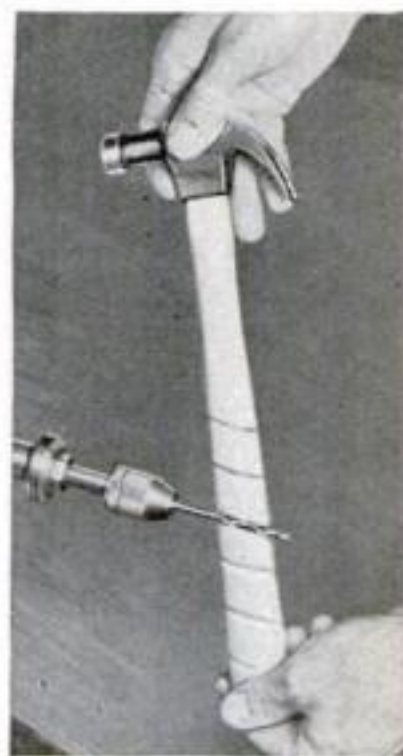
Quick-Acting Holdfast Speeds Bench Work

THIS quick-acting bench holdfast is adjustable for height and can be swung in a circle. It is held at the required height by tightening the knurled nut on the split chuck. Once set for a certain job, each piece can be clamped down or released in an instant by using the handle to compress the stiff coil spring.—C. H. W.



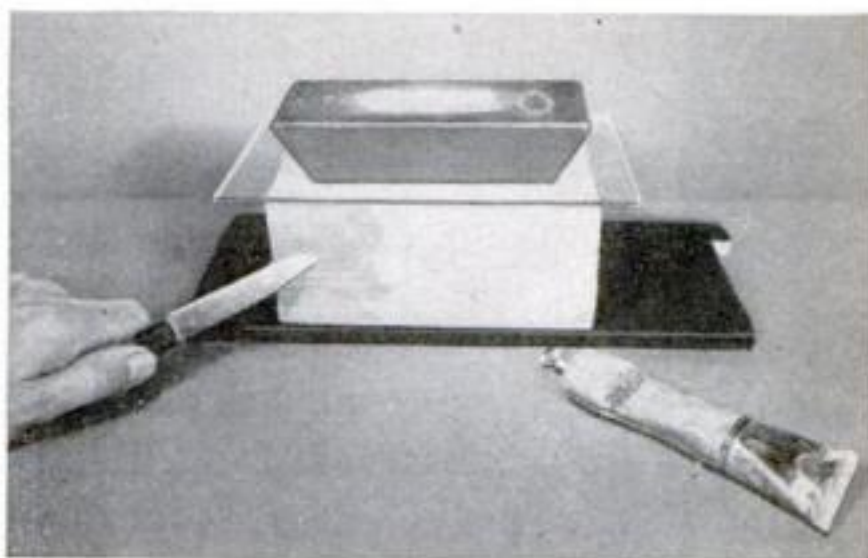
Leather Gives Good Grip on Hammer Handle

A NARROW leather strip wound spirally around a hammer handle provides a neat, nonslipping grip. The groove can be filed in or made with an old 3/16" twist drill. Grind shoulders off the sides of the drill to leave a cutting edge and use it as shown. The ends of the leather are held with small wooden wedges, driven in holes drilled at either end of the groove.



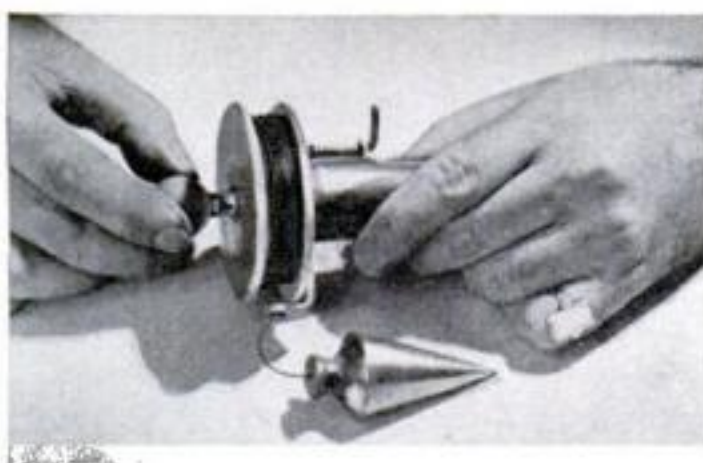
Cold Solder Used for Gluing Up Scratch Pads

ALTHOUGH any good glue can be used in the place of a regular padding compound for making scratch pads from scrap paper, better results can be obtained from the aluminum-colored cement commonly called "cold solder." It dries in five minutes and is waterproof. The pile of paper is squared up all around, a piece of glass or smooth board is laid on top, and a weight of about 5 lb. is placed on top near the edge to be padded. The metallic solder is then applied with a knife to the edge. It dries to a smooth aluminum surface.





The device, shown in use, may be employed for all kinds of work



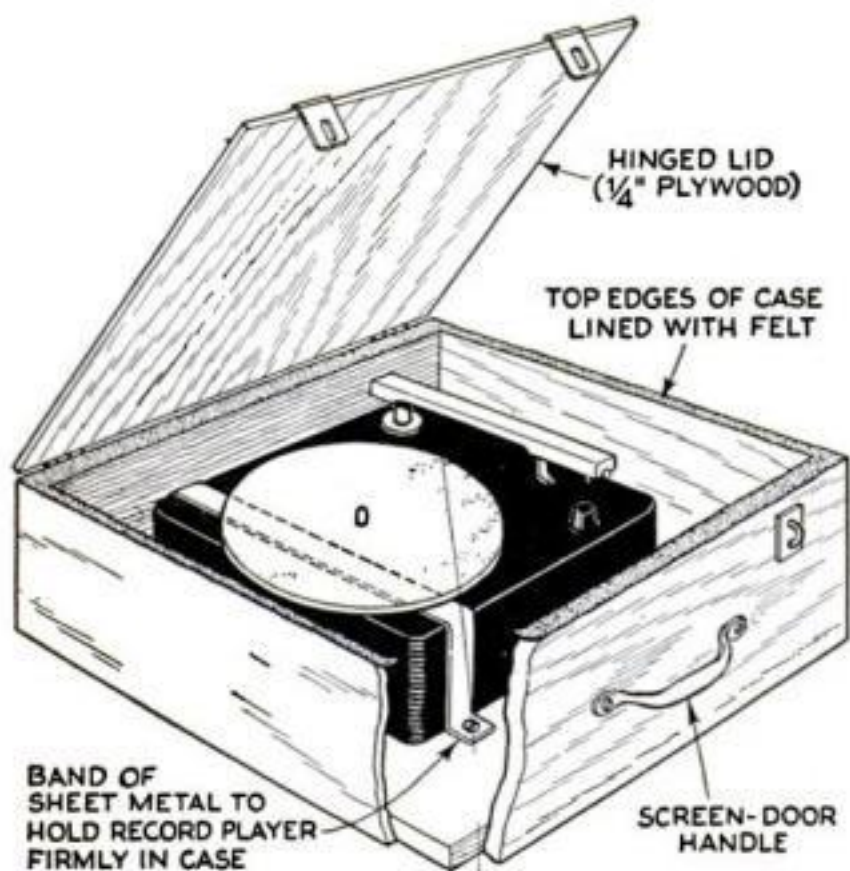
Ralph Doremus, stage carpenter for the magician, Blackstone, devised this reel

Release on Reel Regulates Length of Plumb-Bob Line

WHEN a plumb line is used frequently, this device, which is somewhat like a casting reel, greatly simplifies the lining up of all kinds of work. By working a release with the thumb, the plumb bob is allowed to drop for exactly the required distance.

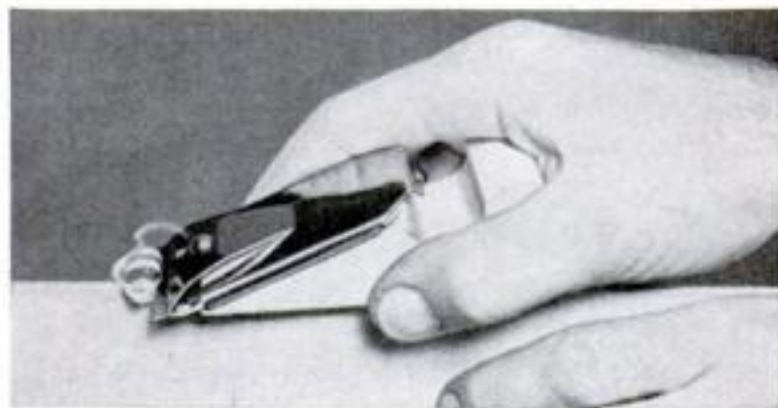
A length of brass pipe is used for a handle and is bolted to an aluminum reel made from two disks and a spacer. A winding knob is bolted to one side of the reel, while the edge of the other side is drilled with holes to receive a stop pin. The latter, equipped with a strong spring, is held in a bracket soldered to the handle. Also soldered to the handle is a casting-rod tip with agate guide. If the plumb bob is small enough, it may be stored inside the handle, which may be closed with a cork.

A length of brass pipe is used for a handle and is bolted to



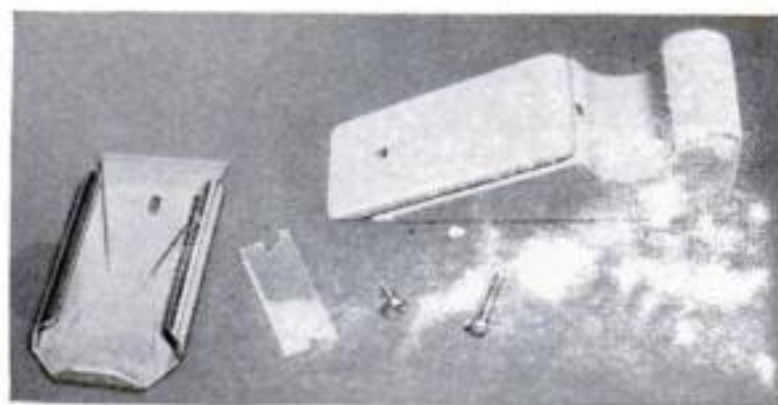
Box Quiets Needle Noise of Record Player

RECORD-PLAYING attachments for use with a radio set are sometimes disappointing because of the objectionable surface noise of the needle. This can be muffled by making a box large enough to hold the player with room to spare for needles, plugs, and accessories. The base and ends may be made of $\frac{3}{4}$ " white pine, the sides and top of $\frac{1}{4}$ " plywood. It is important that the joints fit snugly.—CHARLES ROBERT AVERY.

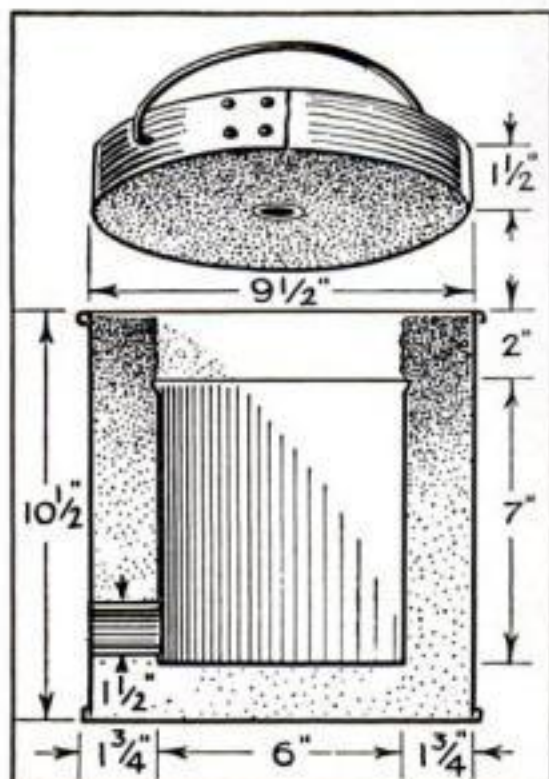


A Model Maker's Plane

MODEL makers will find this neat little plane gets right into corners and difficult places. It is made from a block of maple wood, a heavy single-edged razor blade, and a piece of nickel-plated brass. The underedge of the cap is filed off to fit the blade tightly. The blade is adjusted by the screw at the top end of the metal piece.—B. N.



INEXPENSIVE Gas Furnace Melts Soft Metals



Lifting a crucible of molten metal from the furnace. Left, how the furnace is constructed



A GAS furnace that will hold a No. 7 crucible can be built for about fifty cents exclusive of the burner. In this type of furnace, pewter, britannia metal, bronze, aluminum, and soft pottery glazes can easily be melted.

From a painter obtain a 2½-gal. paint bucket, and from a restaurant a 3-qt. fruit can. Buy a strip of galvanized iron 1½" by 35", any gauge from 20 to 30, or get an old strip from a junkman. Obtain 15 lb. of fire clay, some discarded fire brick, and a 3' length of 8-gauge wire.

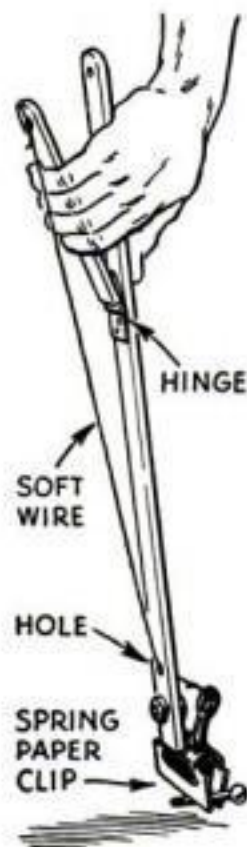
Out of the tin from a can, make one tube 1½" in diameter and 2" long, and a second tube 1" in diameter and 1½" long. Now cut one hole 1½" in diameter at the bottom of the 3-qt. can and another 1½" up from the bottom of the paint bucket. These holes are to be connected with the 1½" by 2" tube. Pound up fire brick into grog of pea size. Use one-third grog and two-thirds fire clay and make a stiff mixture with water. Tamp a layer 1½" thick on the bottom of the paint bucket. Set in the fruit can and fit in the tube. Tamp the clay and grog in tightly up to the top of the can, and then finish off the last 2" by pressing the mixture in with the hands.

Make the cover as shown with the strip of iron riveted to form a ring the size of the paint bucket. Set the 1" tube in the center as a gas vent. Ram tightly with clay and grog. When dry, fill in the shrinkage

space with fire clay. Punch holes in the opposite sides for the wire handle.

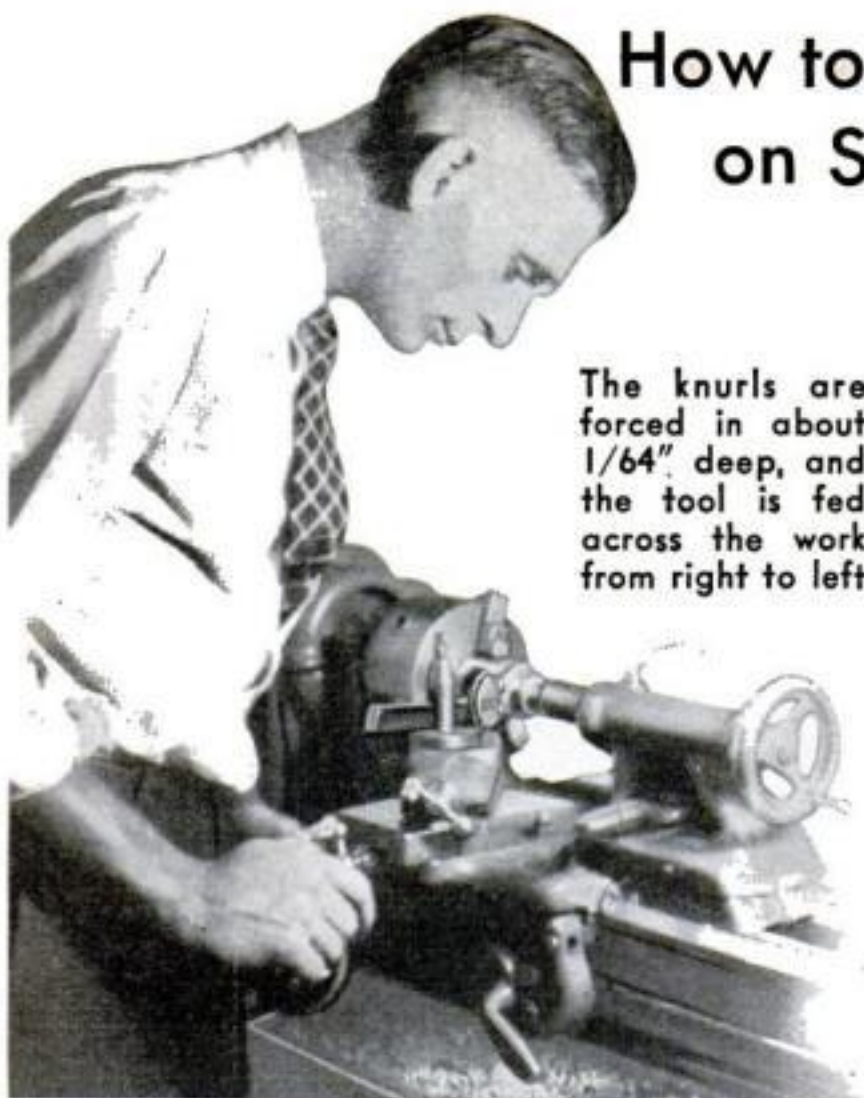
Dry the whole furnace thoroughly for several weeks and then fire slowly with a gently increasing flame for a number of hours, using a standard type of Bunsen burner.

For the burner to use with the furnace, it would be well to consult the local gas representative because the type varies according to the gas available. Ours does equally well with or without additional air pressure. A temperature of 2,000 deg. F. can easily be obtained with the furnace illustrated. Standard pyrometric cones are used in the heats. The furnace should last for a number of years.—R. H. JENKINS.



Pick-Up Retrieves Small Lost Parts

A LIGHTWEIGHT pick-up for small articles that fall on the floor and roll under the work-bench can be made as shown from a steel spring clip of the type sold in stationery stores, a short piece of soft wire, a small hinge, and two sticks. The main stick may be any length desired; it is then necessary that the wire be fastened so it is taut when the hinged handle is in an open position and the spring clip closed.—C. H. W.



The knurls are forced in about $1/64$ " deep, and the tool is fed across the work from right to left

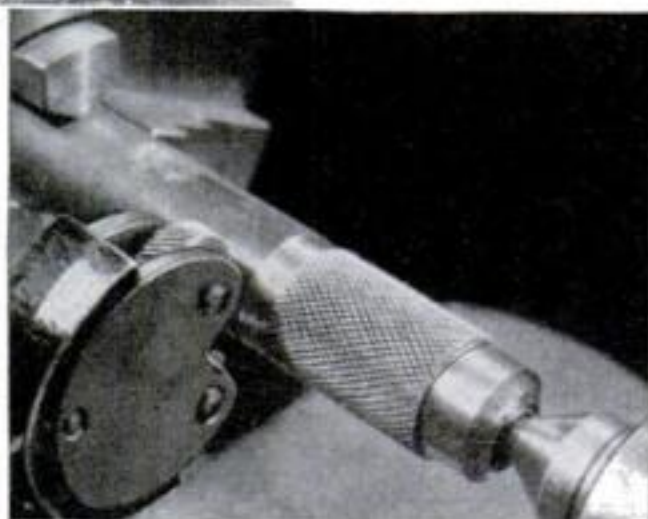
How to Do Workmanlike Knurling on Small Parts in the Lathe

KNURLING adds much to the appearance and usefulness of many small jobs. The knurling rollers in the tool shown are removable and can be replaced by rolls of finer or coarser pitch. In using a tool of this kind, both the work and the rolls should be well oiled.

It is best to start the tool on the right-hand end of the work. When the knurls have been forced in to a depth of about $1/64$ ", the longitudinal feed of the carriage is set and the tool fed across the face of the work. The knurls can be forced in deeper, the carriage feed reversed, and the operation repeated until the proper depth has been reached. It is advisable to leave the rolls in mesh with the impressions they have made until the work is finished.



Oil must be applied freely because of the pressure used



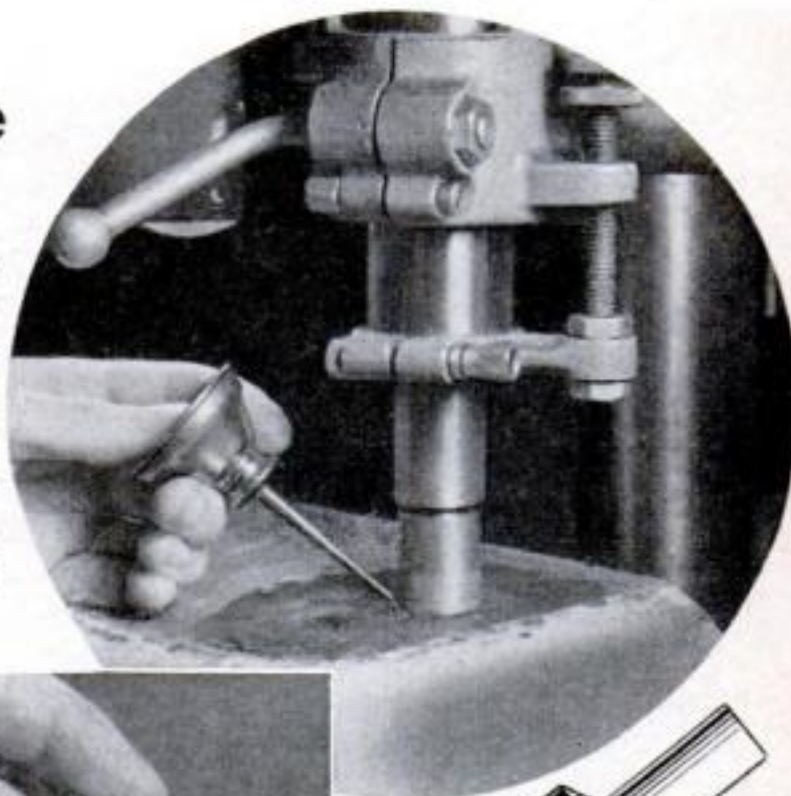
The impressions are deepened by repeating the knurling operation



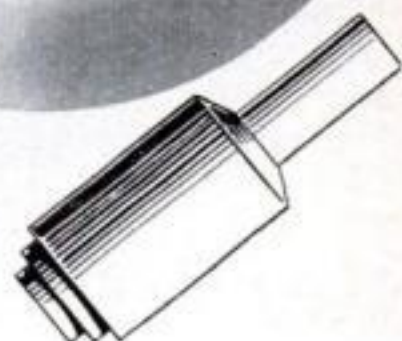
When the knurling is finished the part is shaped as required

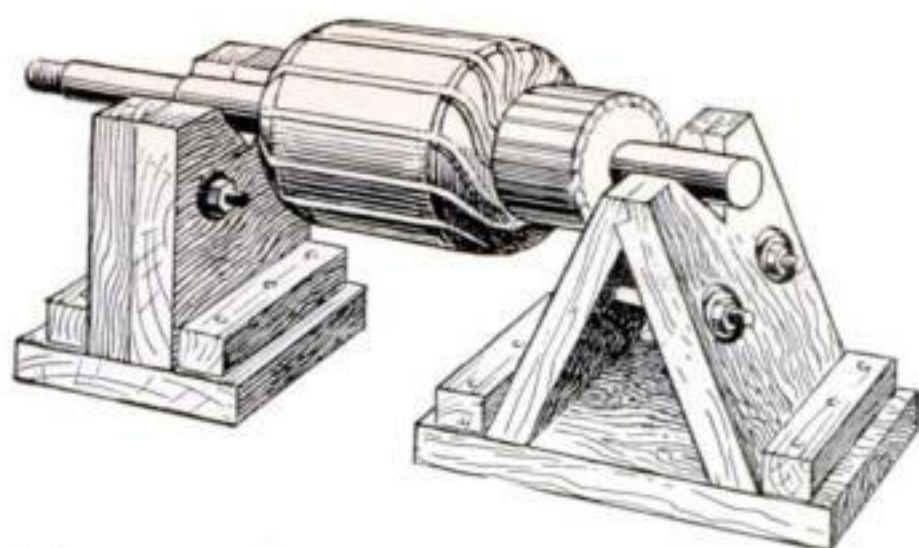
Easy Way to Bore or Enlarge Holes in Porcelain

IT IS sometimes necessary to enlarge the hole for the water-line connection in an old porcelain flush tank in order to install present-day fittings. This can be done, if a drill press is available, by using a tool turned from brass rod as shown. Carborundum grains (No. 80) and turpentine are fed around the bit during the operation. The actual grinding in this case required about forty minutes, and the steps of the tool were worn away. If a new hole has to be made in porcelain, use a metal tube for a tool.



Try to win our new "what-do-you-like-best" contest. Prizes total \$100. "Our Readers Say" Department in this issue gives all details.





Heavy-Duty Shop Stands of Wood

LIGHTWEIGHT V-stands or plain blocking for shop purposes can be made from any available hardwood. The A-shaped type has a simple but efficient interlocking joint at the upper edge. The inverted-T stand is simpler, but note that the two vertical pieces of plank are arranged with the grain of one crossing the other. In both cases the up-rights are strongly bolted together.



Special Carrier Handles Large Steel Drums

IN A small plating plant or the finishing department of a factory that does not have the advantages of modern handling equipment, the task of moving heavy drums without rolling can be done with a drum-handling dolly constructed as shown below. If ruggedly made from steel, the crane arms will lift a heavy drum with ease and will last a lifetime.—CHARLES H. WILLEY.



Fastening a Drill-Chuck Key So It Won't Be Lost

IF THE chuck key is fastened with friction tape some distance back on the electric cord of a portable power drill, as at the left, it will never get lost.—B. K.

SELECTION OF GRINDING WHEELS

[METAL WORKING]

Abrasive—Fused alumina for materials of high tensile strength, silicon carbide for low tensile strength.

Grain size—Fine grain for hard and brittle materials, for small area of contact, and for fine finish; coarse grain for soft, ductile materials, for large area of contact, and for fast cutting. The numbers that designate grain size represent the number of openings per linear inch in the screen used to size the grain: 8 to 10, very coarse; 12 to 24, coarse; 30 to 60, medium; 70 to 120, fine; 150 to 240, very fine; 280 to 600, flour sizes.

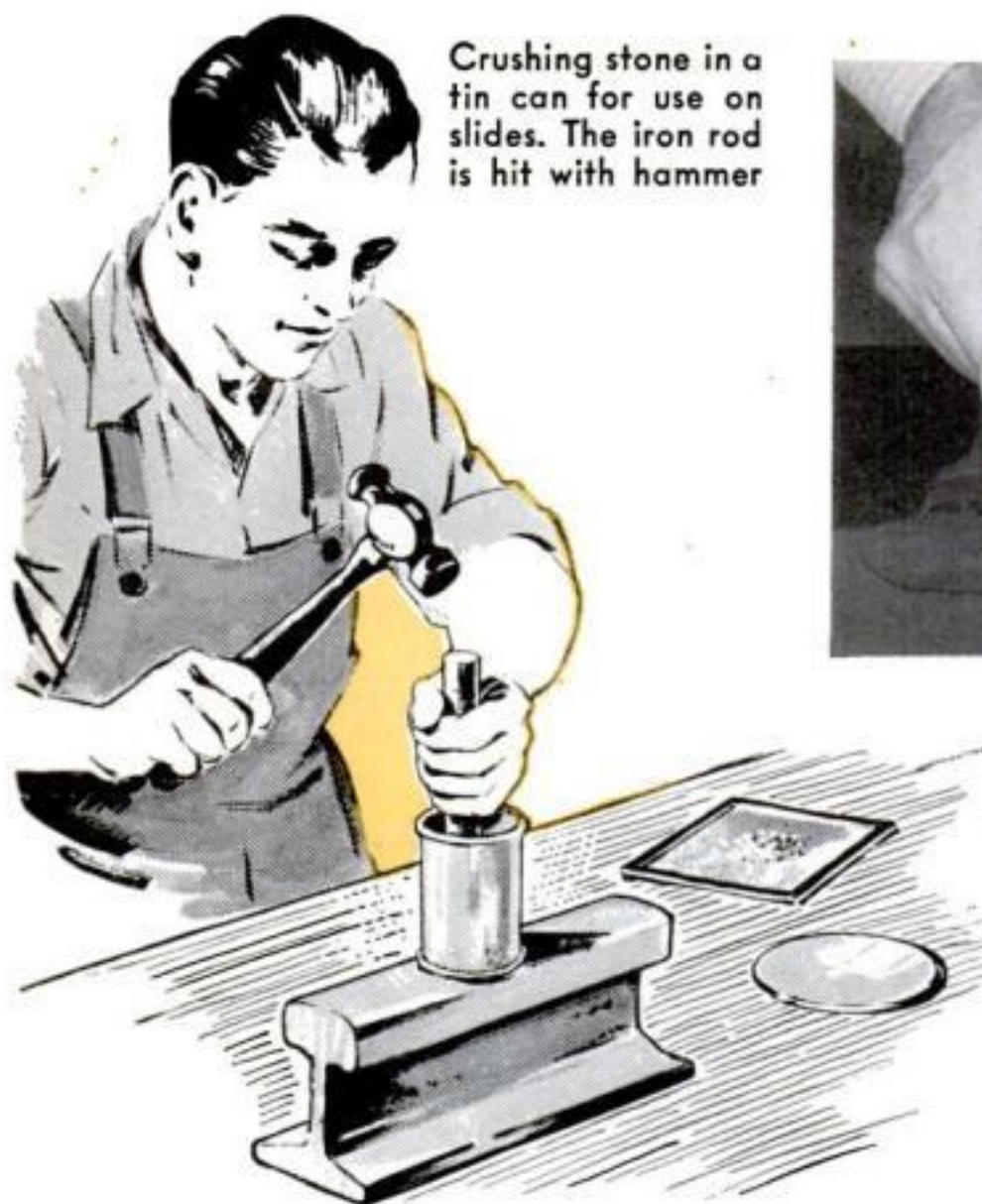
Grade—Hard wheels for soft materials; soft wheels for hard materials. The smaller the area of contact, the harder the wheel should be. Grade is often designated by letters: E to G, very soft; H to K, soft; L to O, medium; P to S, hard; T to Z, very hard.

Structure—Close grain spacing for hard and brittle materials, for small area of contact, and for fine finish; wide grain spacing for soft, ductile materials, for large area of contact, and for rapid removal of stock. Numerals are sometimes used for spacing: 0 to 3, close; 4 to 6, medium; 7 to 12, wide.

Bond—Resinoid, rubber, and shellac wheels are best for a high finish. Vitrified can be used for speeds up to 6,500 surface feet per minute; rubber, shellac, or resinoid for speeds above that.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Secrets in Stone Revealed



Crushing stone in a tin can for use on slides. The iron rod is hit with hammer



After sifting through a screen, the crushed stone is scattered on balsam-coated slides

THE lowliest pebble in your garden may prove to be a fairyland of color and gemlike shapes, if you subject it to the scrutiny of your magic lenses. Microscopic study of rocks is a highly important activity of science. Petrographers—scientists who work with rocks—would be lost without the microscope. Although there are rock materials whose structure can be deter-

mined sufficiently with an ordinary magnifying glass, there are many whose structure is too fine to be studied except at high magnifications.

Although you probably do not have the specialized equipment of the petrographer, you can nevertheless spend many enjoyable hours exploring the mysteries of pebbles, stones, boulders—and whole mountain peaks if you want to. To get your material, all you need do is scout around a bit outdoors, pick up some pebbles or knock some chunks out of larger rocks with a hammer, and take them back to your laboratory. On your collecting expedition, try to get a sample or two of limestone (perhaps from a driveway), and some specimens of other kinds of rock



A piece of rock mounted in a pill box for examination. Inside of the box is painted black



The first step in grinding down a specimen is to heat balsam for cementing rock to a slide

by Your Microscope

By MORTON C. WALLING

that contain glittering, glasslike particles.

With a hammer and a large rock on which to rest the smaller pieces, break them into still smaller fragments, say less than $\frac{1}{2}$ " in their longest dimension. Pick out the thin, flat ones, and lay them aside for later preparation.

Pick out a fair-size chunk of the rock you are studying, and mount it so you can examine its surface with your microscope. There are two principal ways of making such permanent mounts. One is to place the piece in a deep cell on a slide, and the other is to mount it in a small, round pill box.

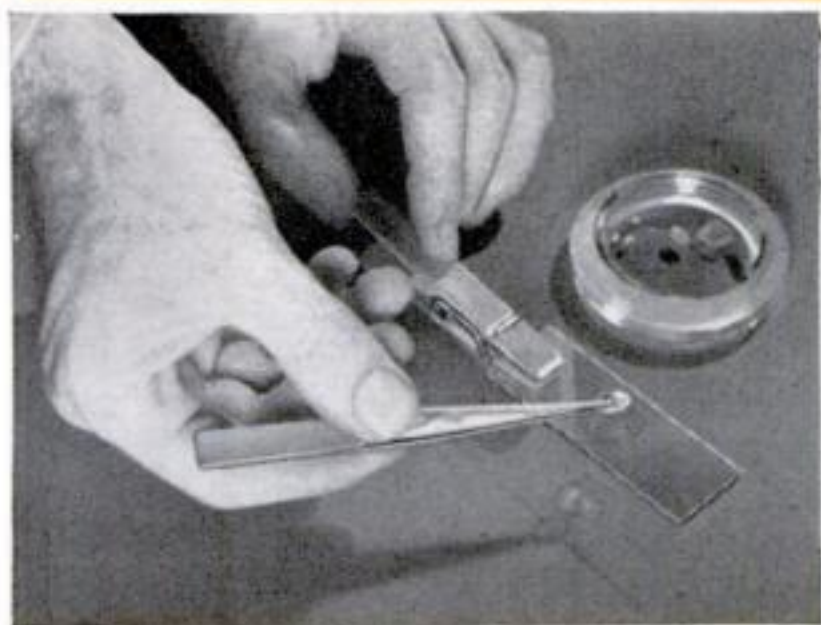
You can buy little glass rings or squares of various sizes that can be cemented to an ordinary slide with balsam. These are a bit expensive. A much cheaper way is to build up circular or square cells from strips of cardboard and then render them moisture-proof by saturating them with shellac, lacquer, or varnish. Still another way is to bore a hole, say $\frac{5}{8}$ " in diameter, in a strip or block of wood, or in a block made by gluing several layers of cardboard together.

Whatever the cell material, the inside dimensions should be such that a standard cover glass will fit over it. The depth should be sufficient to hold the specimen, say 5 to 10 mm. Paint the inside of the cell black, and use a layer of black paper over the glass at the bottom. The piece of rock is fastened, with balsam or with quick-drying pyroxylin



A section of rock as viewed by polarized light

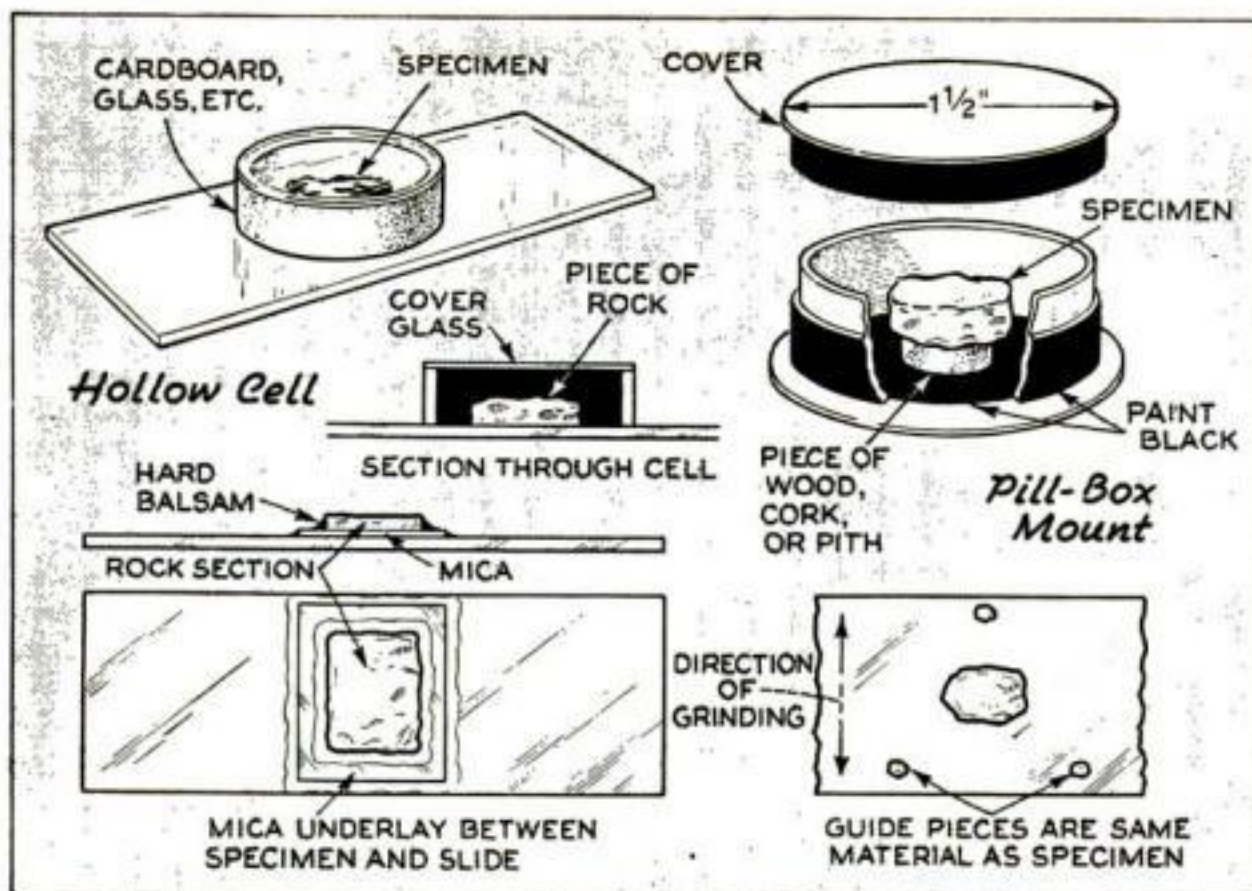
cement, to the bottom of the cell or to a little support of cork, pith, or wood. Just before cementing the cover glass in place, heat the slide, cell, and specimen gently, to drive out moisture. A cover glass is not absolutely necessary, but will serve to keep the



Attaching the piece of stone to a sheet of mica on the slide to grind the first side



Stone sections are ground on a wet abrasive stone. The hardest part is to keep the slide flat and avoid producing a convex surface



Details of cell mounting, pill-box mounting, and grinding rock sections

specimen clean and protect it from harm.

The second way of mounting small pieces of rock is to cement them to supports of cord, pith, or wood which in turn are fastened to the bottoms of small, rounded pill boxes like that shown. Square boxes will do just as well as round ones. Paint the inside of each box black with India ink or dull lacquer. The lid provides sufficient protection against dirt and damage, so a cover glass is not needed. Since the microscope is used at

low power for examining such specimens, the pill boxes can be set on the stage without trouble. Slides of crushed rock make interesting specimens for microscope examination, and some of them are particularly beautiful in polarized light. Crush the rock with a hammer, and sift it through a fine-mesh screen to remove large chunks. Mount the particles in a single layer on a standard slide, either in a shallow cell or without any such protection. To make the particles adhere to the glass, coat the center of the slide with a thin layer of balsam. Distribute the crushed stone over the balsam, and set the slide aside for a day or two. Jar off all unanchored particles, and if the specimen is to be covered, apply the cover glass. A quicker way is to heat the balsam gently to drive out some of the solvent, after it has been spread on the slide, and drop the particles on it immediately. When the balsam cools it will be hard.

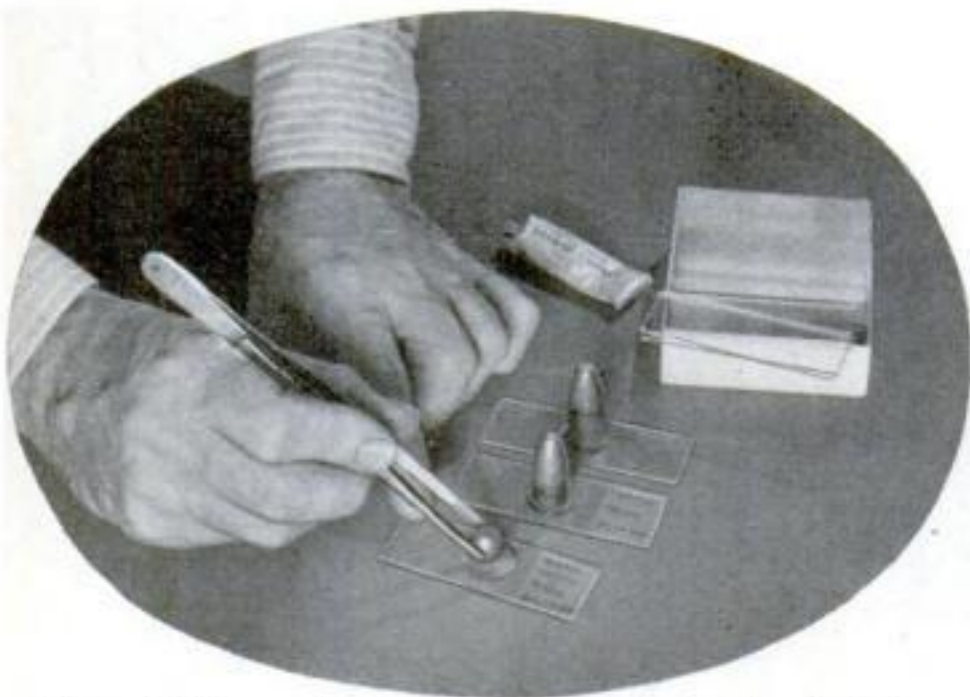
The making of thin sections of rock is considerably (Continued on page 246)

Weights Hold Cover Glasses Down

IN MOUNTING microscope specimens permanently in balsam on 1" by 3" slides, it often becomes a problem to hold the cover glasses down firmly while the bal-

sam sets. Various clamps and other gadgets have been devised for doing this, but one of the simplest stunts is as follows:

Obtain an assortment of lead weights in the form of short cylinders 1/2" to 5/8" in diameter. Be sure that one end at least is perfectly flat and square with the sides, so the cylinder will stand upright. There should be several lengths, to give a variety of weights ranging from about 1/2 oz. to 2 or 3 oz. When the cover glass has been applied, lay the slide on a perfectly level surface and carefully set a weight in the center, using a light weight for delicate specimens like diatoms or insect parts, and a heavier weight for more rugged subjects such as rock sections. Weights shown in the illustration at the left were made originally as bullets for muzzle-loading guns.



The weights used here are old muzzle-loader bullets

Table-Top Oil Refinery

FOR THE HOME CHEMIST

By
**RAYMOND B.
WAILES**

"MECHANIZED Armies Make Oil Supply Vital," "Shortage of Fats Imperils Nation at War"—headlines like these spotlight what used to be routine items in a country's shopping list, and give them new interest for home-laboratory experimenters.

Envious eyes the world over turn toward our vast forests of oil derricks, and the rivers of crude oil that refineries turn into gasoline for vehicles of war and peace. What makes their enormous production possible is the modern "cracking" process for extracting gasoline. Once the crude oil was simply distilled to separate, in turn, the gasoline and other substances it contained. Today, in addition, by-products of the distillation are "cracked" or broken down into gasoline, doubling the total yield.

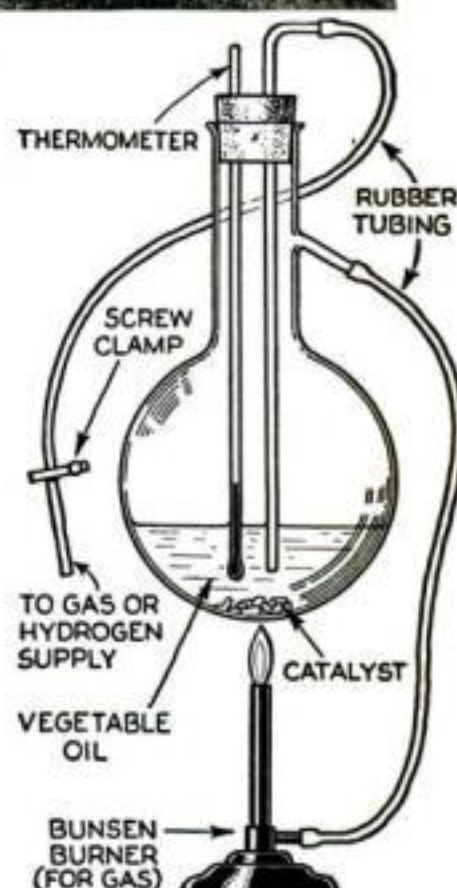
You can demonstrate for yourself how this is done, with a miniature cracking unit. Its furnace may be a test tube, preferably of heat-resisting glass. Fit the test tube with a one-hole stopper, and connect it with a small flask or a side-necked test tube. This second vessel catches the condensate from the cracking reaction. Finally, the condenser should be fitted with a straight glass delivery tube so that "refinery gas" formed in the reaction will issue from it and can be burned.

White mineral oil, the ordinary medicinal kind that you can buy at the corner drug store, will serve as your raw material. Place about five cubic centimeters (a teaspoonful and a half) of the oil in the first test tube. Fill the space in the tube above the oil with a wad of steel wool, to obtain a greater cracking area. Keeping the top of the test tube hot will heat the steel wool in turn, and oil vapors coming in contact with the hot material will crack, or decompose.

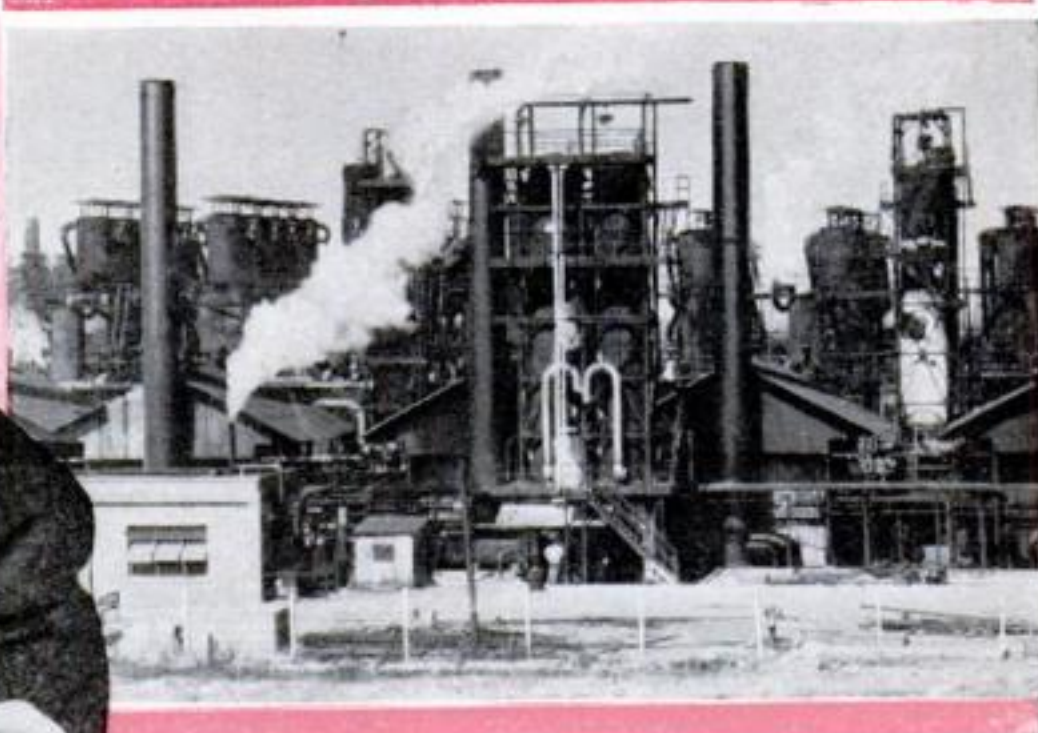
Start the experiment by slowly applying the flame of a Bunsen



Converting a liquid oil into a solid fat, by the process used in making vegetable shortening. The apparatus is shown below



In the simple experiment illustrated at the lower left, you can duplicate the process employed in great industrial plants in "cracking" oils for petroleum products



burner, fitted with a flame-spreading attachment, so as to heat the oil and the steel wool simultaneously. The oil will soon reach its boiling point. As the oil vapors pass through the hot steel wool, they break down into a number of lighter petroleum "fractions" or products, including gasoline and also combustible gas. You can light the gas at the end of the delivery tube.

When all the oil in the first test tube has been vaporized, let the apparatus cool. You will find an oily product in the flask or side-necked test tube that has served as a condenser. Its odor alone will tell you that something has happened to the mineral oil that you started with, and a simple experiment will confirm this.

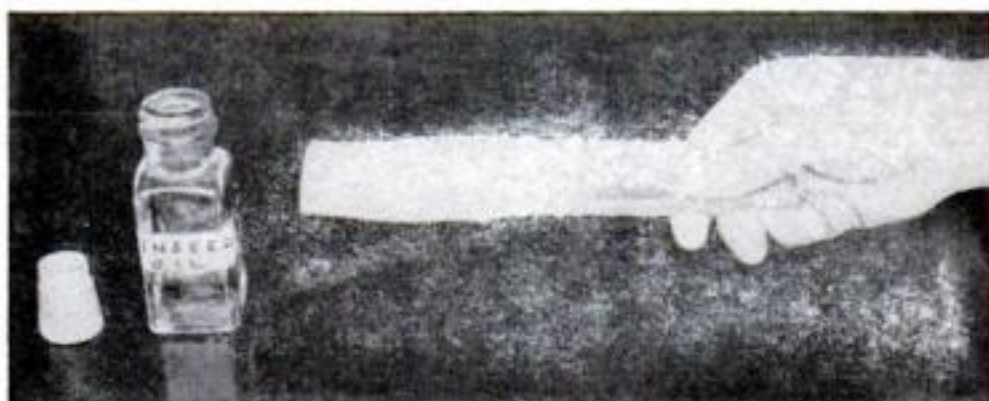
Gently shake a teaspoonful of mineral oil with an equal quantity of

strong sulphuric acid, in a test tube, and do the same with the residue from your condenser. Notice that nothing happens in the first case. The mineral oil consists of what a chemist calls paraffin hydrocarbons, which sulphuric acid does not attack. But sulphuric acid promptly imparts a brown discoloration to the residue from the cracking experiment, showing the presence of "olefines" or "unsaturated hydrocarbons" such as are found in natural petroleum. In other words, you have changed back a refined product into one more akin to crude oil.

In commercial practice, this cracked oil is redistilled to separate the gasoline, kerosene, gas oil, and other "fractions" of which it is a mixture. Of course, pure white mineral oil is not the commercial raw material, but it illustrates the cracking principle nicely.

Instead of breaking down molecules of oil, you can build them up, by the method known as "hydrogenation." This is the process used to produce well-known brands of lardlike shortening fats, glistening snowy-white solids, from liquid vegetable oils such

Linoleum in the making: a strip of cloth on which linseed oil has been allowed to oxidize. Already it is stiff enough to be held horizontally



● EXPERIMENTS WITH OILS AND FATS REPRODUCE

as cottonseed oil. Chemically, it consists simply of adding hydrogen to the original molecules.

That isn't quite as easy as it sounds, however, unless you know the trick. You must have the aid of a catalyst, one of those curious agents that promote reactions without undergoing any change themselves. In this case you can prepare your own catalyst.

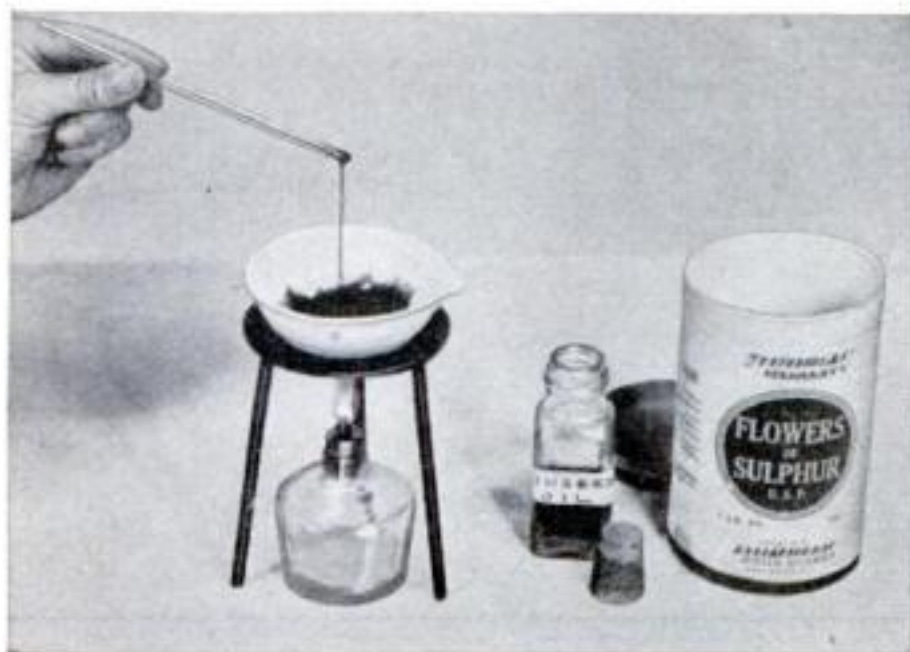
FIRST, add a solution of sodium hydroxide or of potassium hydroxide to a solution of some nickel chemical—nickel sulphate, nickel nitrate, or nickel chloride, for example. The strengths of the solutions do not matter. Mixing them will yield a light-green precipitate of nickel hydroxide. Let it settle, and then pour off the clear liquid above it. Add fresh water; shake well; let the precipitate settle; and pour off the clear liquid again. Repeat this "washing by decantation" several times, to free the nickel hydroxide from other chemicals. Then filter out the precipitate and dry it. Place the dried product in a Rose's crucible, or in an eight-inch length of glass tubing with an inside diameter of about half an inch. Pass hydrogen gas over the nickel hydroxide while you heat the outside of the tube or crucible. The hydrogen reduces the nickel hydroxide to metallic nickel. This reduction should be carried out at a temperature a little below red heat, and allowed to proceed for about fifteen minutes. The hydrogen may be supplied from a simple acid-metal generator, or illuminating gas, which contains free hydrogen, may be used. In either case, the gas that has passed over the contents of the tube or crucible should be led away and discharged outdoors.

When your homemade nickel catalyst is ready, place it in a distilling flask and add one or two fluid ounces of a vegetable oil, such as cottonseed oil or salad oil. Cork the flask with a two-hole stopper. Through one

hole, a chemical thermometer should dip into the oil. The other hole carries a glass tube, also dipping into the oil, through which hydrogen gas can be delivered.

Heat the oil to about 175 or 200 degrees centigrade (350 or 375 degrees Fahrenheit) and keep it at this temperature while hydrogen gas bubbles through the oil for about twenty minutes. Here, again, ordinary illuminating gas may be substituted for hydrogen. If you use illuminating gas, you can lead the excess gas from the exit tube of the distilling flask to a Bunsen burner, and use it to heat the flask—just as by-products are put to use in industrial processes. But if pure hydrogen gas is used, do not try to burn it. There would be danger that the flame would "strike back" into the flask, and explode any hydrogen-air mixture that might be there. Out the window, through rubber tubing, is the best way to dispose of the left-over hydrogen.

After this twenty-minute treatment of the oil, turn off the gas supply and let the flask cool. If all has (Continued on page 245)



Hydroquinone, added to a vegetable oil used as a heating bath, will keep the oil from becoming rancid. Left, making a rubber substitute by heating sulphur and linseed oil

IMPORTANT PROCESSES USED IN INDUSTRY •



Sections of Old Auto Tires Keep Gate Closed

GATES of the type shown above can be fastened securely for all ordinary purposes by placing sections of old tires opposite each other on gate and gatepost. The sections should fit snugly against each other and be painted to match the gate.—E. REYNER.

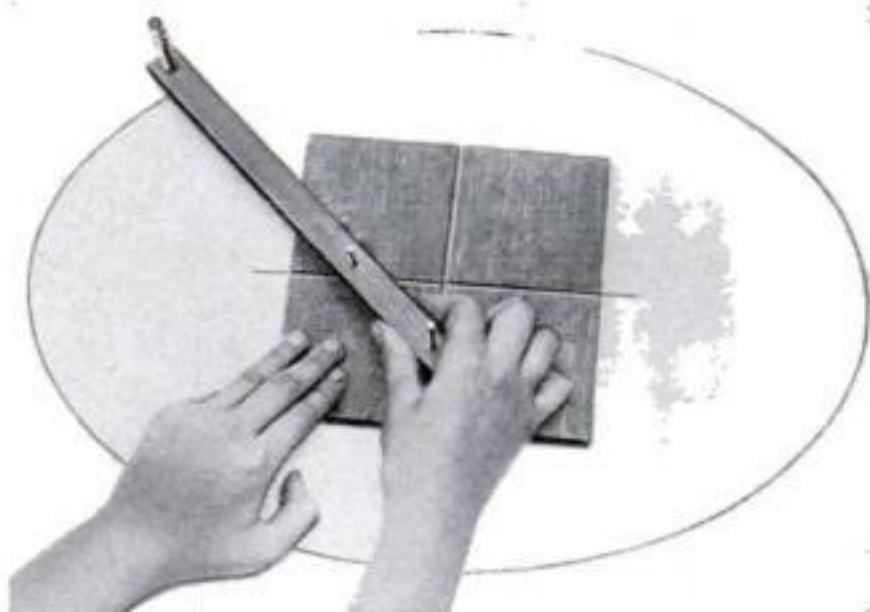


Thin Bicycle-Rim Cement Repairs Many Articles

A CEMENT that will adhere to metals and other materials and will not become brittle upon aging may be made from an asphaltic-base, bicycle-rim cement resembling tar, which may be found in most hardware stores. It should be thinned with cigarette-lighter fluid, high-test gasoline, or carbon tetrachloride, then brushed on both surfaces and allowed to dry for a minute before the parts are pressed together. This cement is particularly useful for repair work on camera bellows, focal-plane shutters, and coverings.—ARMISTEAD WHARTON.

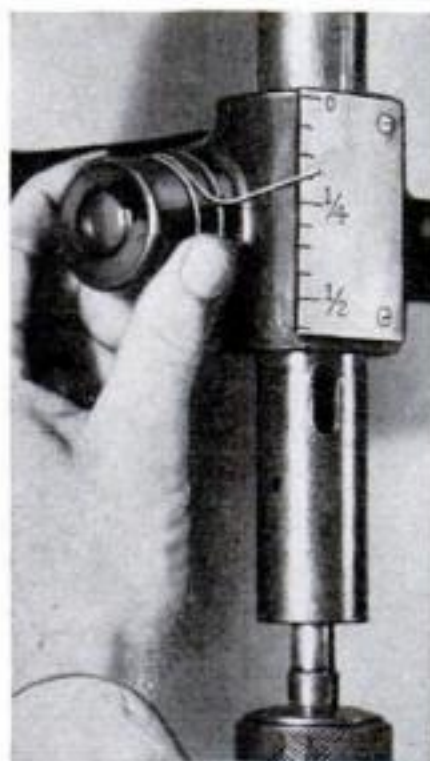
Improvised Ellipsograph Draws Perfect Ovals

FOR drawing perfect ovals, a substitute for a draftsman's trammel or ellipsograph can be made as shown below. The arm is a straight stick with a hole in one end for the pencil. At the other end two nails are driven through the wood so the points project slightly. The distance between the nails represents the difference between the required length of the oval and its width. The base is a square piece of wood about $\frac{1}{4}$ " thick and a little larger than twice the distance between the nails. Two grooves about $\frac{1}{8}$ " deep are cut through the middle of it at right angles to each other. By sliding each of the nails completely back and forth in its individual groove, the oval may be drawn.—CHARLES J. LONG.



The projecting nail points slide back and forth in the two grooves while the pencil moves around

An Accurate Depth Gauge for the Drill Press



TO MAKE a simple yet accurate depth gauge for the drill press, bend a pointer of piano wire, about 0.035" in diameter, for a spring fit around the pinion shaft as shown. Attach a 16-gauge aluminum plate to the front of the press so that the wire travels along one vertical edge. Graduate the plate to represent sixteenths of an inch.

Getting Longer Service from Scroll-Saw Blades

EXTREMELY fine scroll-saw blades, such as are necessary for cutting jig-saw puzzles, are not essential for many other types of fine cutting, and, indeed, are not desirable because they break so readily. For example, I get excellent results by using medium blades such as Nos. 4 and 5 in cutting the small animals and birds I have described in articles in POPULAR SCIENCE MONTHLY. They cut faster than the smaller blades, make wide turns easily, and seldom break.

When V-shape cuts have to be made, I cut the general outline of the design first, omitting the indentations, and then cut each V with two converging cuts as in Fig. 1. If a sharp projection is required, I cut beyond the point, as in Fig. 2, then make an easy turn and come back along the other side of the angle. When two or more pieces are to have an opening through them and are to be glued together afterward, I cut through them as in Fig. 3, then glue them together so that the cuts do not come one above the other. If, however, an opening is to be cut in a single piece of wood, I first drill a hole for inserting the saw blade in the usual way, as shown in Fig. 4.

Most of my work, being very small, is done on a high-speed magnetic saw which, however, has no adjustment to change to a new cutting area on the pin blades when the teeth actually being used have become dull. If the work is not too delicate, I slip a piece

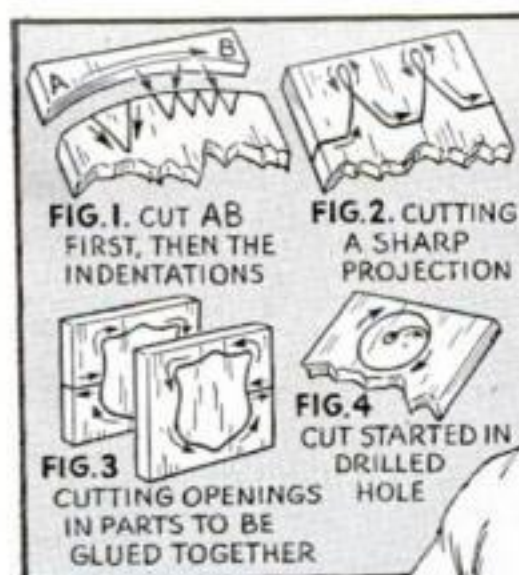


FIG. 1. CUT AB FIRST, THEN THE INDENTATIONS

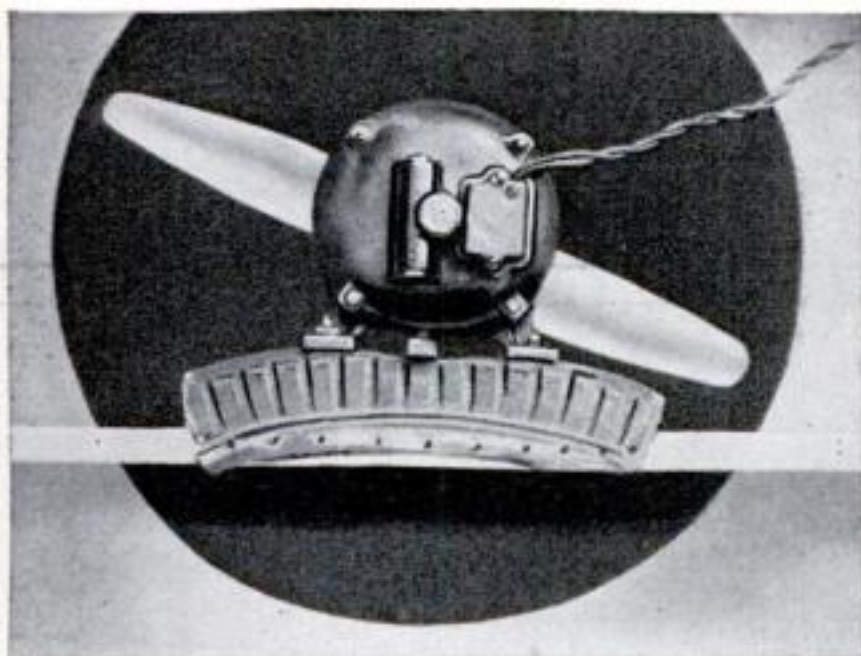
FIG. 2. CUTTING A SHARP PROJECTION

FIG. 3. CUTTING OPENINGS IN PARTS TO BE GLUED TOGETHER

FIG. 4. CUT STARTED IN DRILLED HOLE



of wood under it as soon as the blade has become dull and finish the cutting on an unused section, thus getting considerably longer use. The supporting block has, of course, to be slid around so that the saw does not cut into it.—EDWARD B. FOX.



Old Tire Casing Reduces Vibration of Motor

TO LESSEN vibration and noise from a cooler fan, a section of tire casing was cut with a rip saw and four holes were drilled for bolting the motor to it. The side walls of the casing were then nailed to the edges of a board as shown above.—R. L. BAKER.

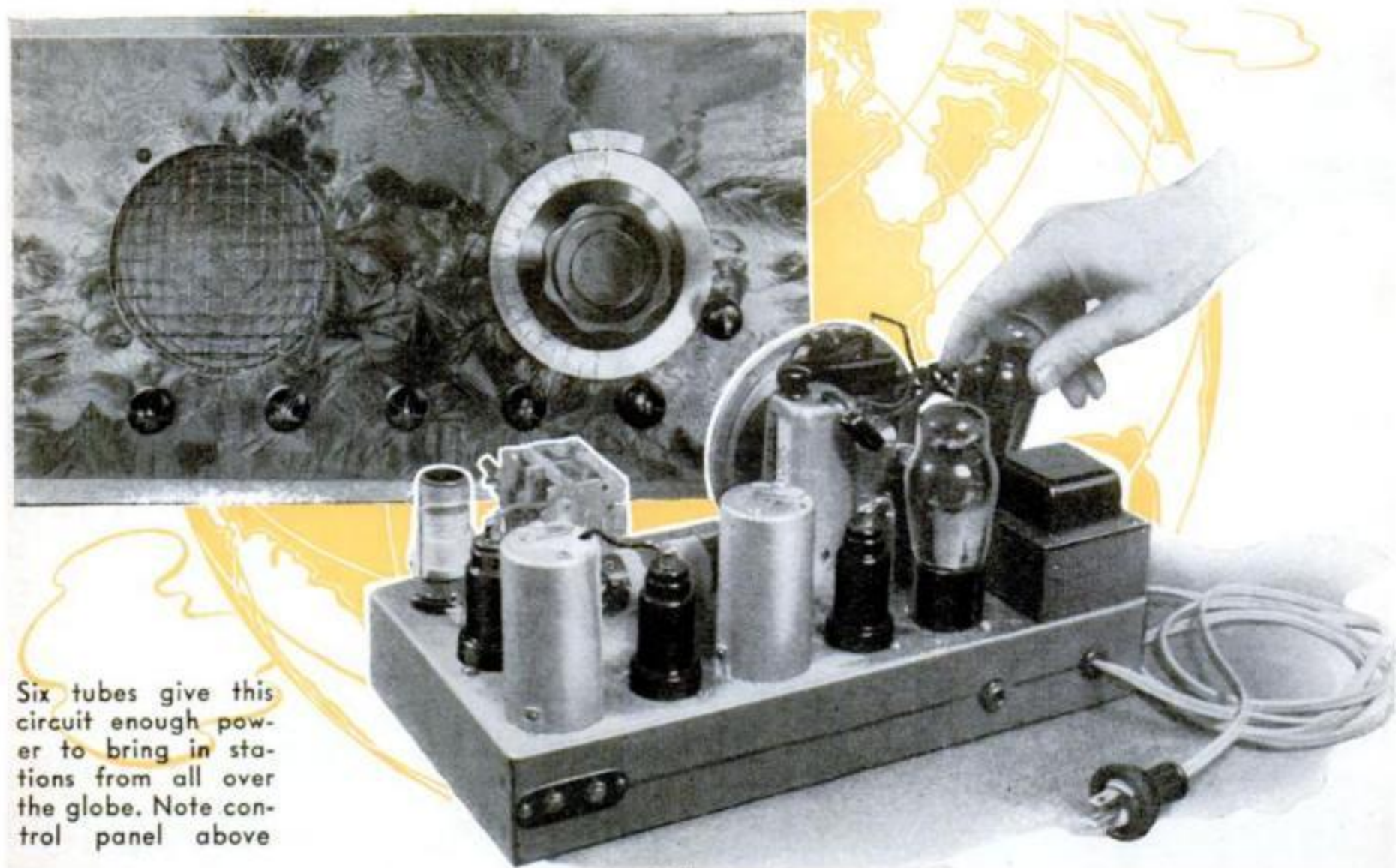
Reflector Acts as Oven for Baking Enamel

A LARGE reflector, such as is often used in making photographs indoors, can be converted into a small but efficient oven for articles that are to have a baked-enamel finish. Insert a 60-watt, or larger, lamp bulb in the reflector, then invert it over the enameled article. The temperature can be increased, when necessary, by covering the reflector with an old blanket to insulate it from the air. Placing the object on top of sheet metal will also increase the heat within.

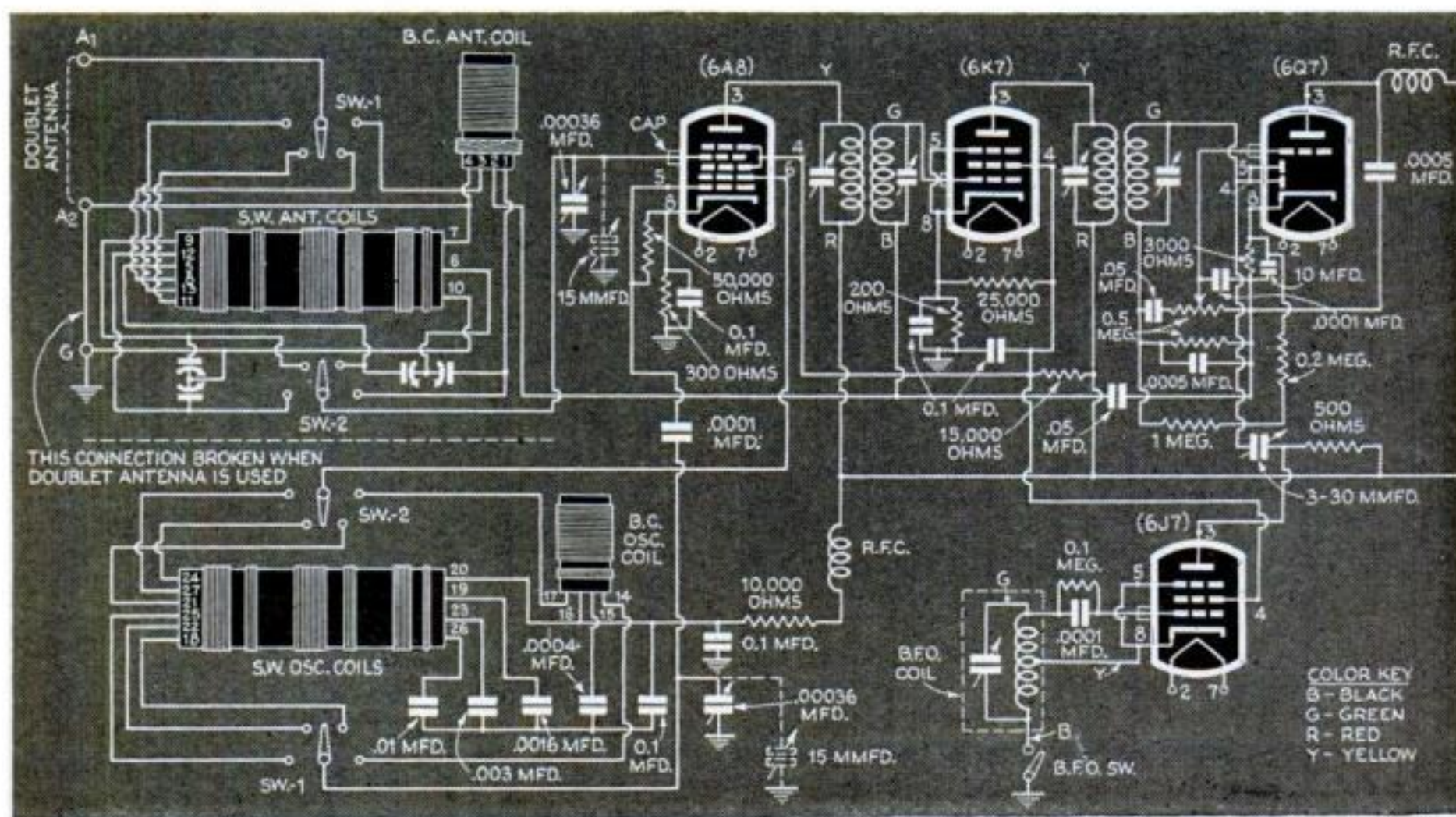


Placing an electric lamp in a reflector over a small metal object in order to bake on a coat of special crackle-finish lacquer

Around-the-World



Six tubes give this circuit enough power to bring in stations from all over the globe. Note control panel above



Receiver COSTS \$20 TO BUILD

By ARTHUR C. MILLER

TWENTY DOLLARS will build this powerful six-tube communications receiver, which includes all the more important features necessary for good all-around reception. Although only six tubes are used, two of these are dual-purpose tubes (the 6A8 which acts as a combined first detector and oscillator, and the 6Q7 which serves as the second detector and first audio amplifier) resulting in eight-tube performance. This set has plenty of power to bring in short-wave stations from any part of the globe.

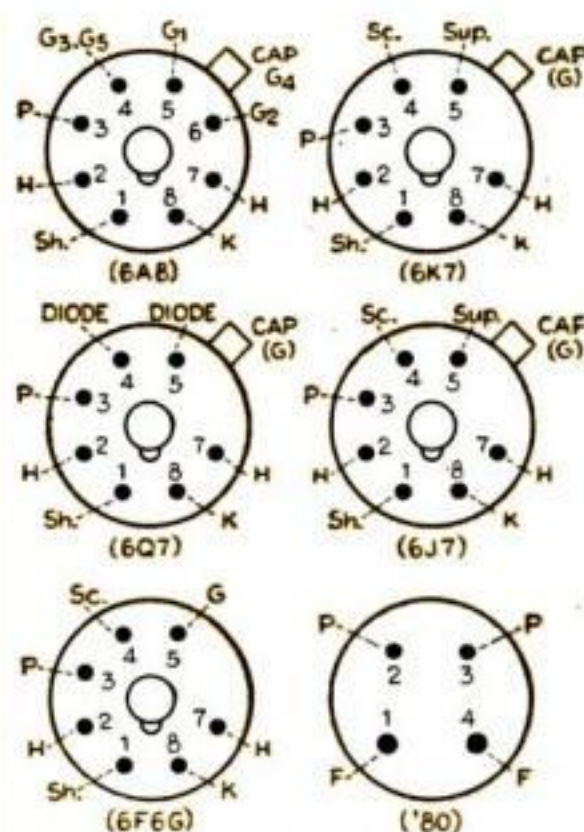
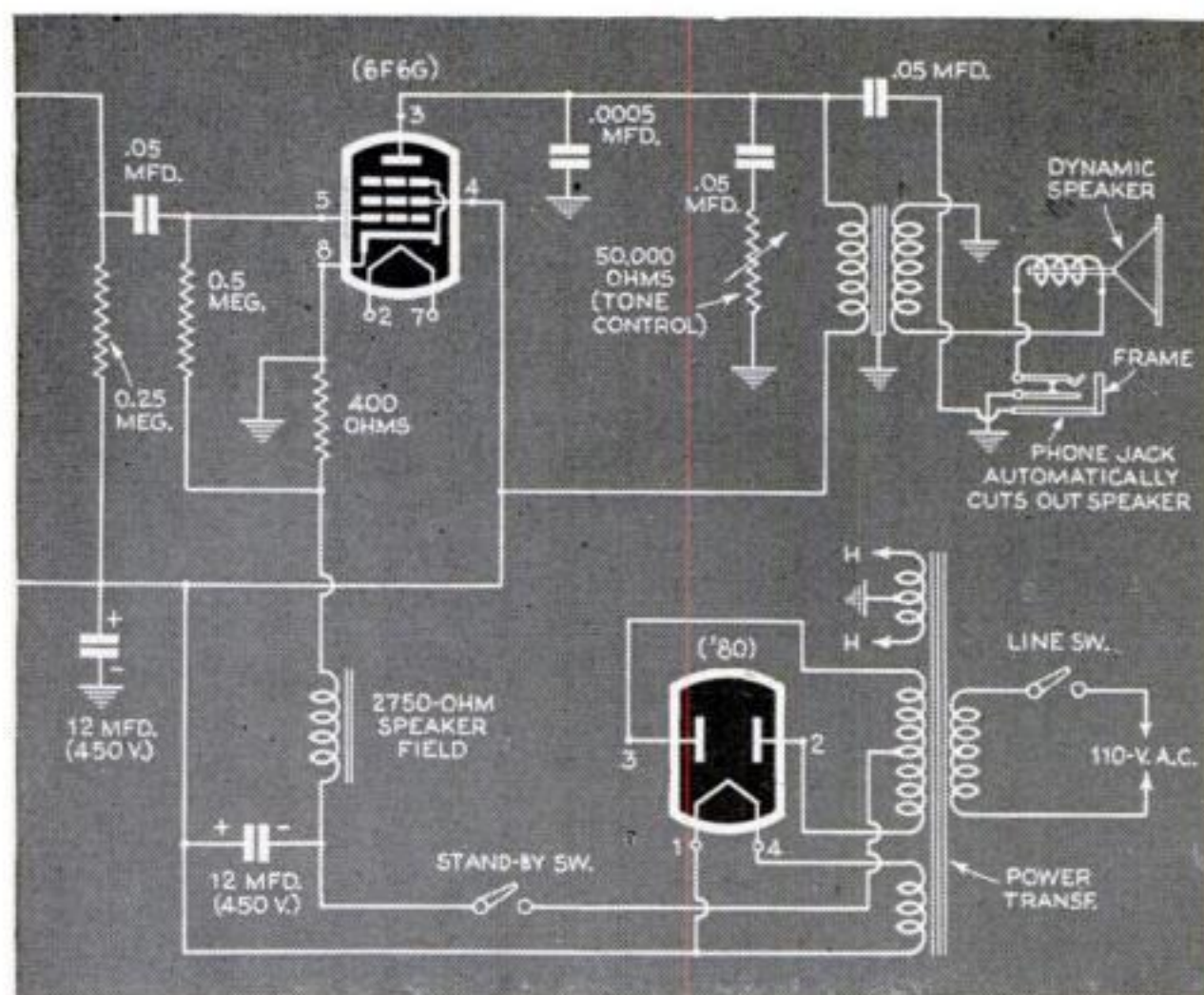
The circuit covers the entire range from twelve meters up to 550 meters. This range is divided into four bands (550 to 200 meters, 200 to 75 meters, 75 to 35 meters, 35 to 12 meters) by means of a selector-type switch which is noiseless in operation. Among its other features are a sensitive, self-contained dynamic speaker, a stand-by switch, a beat-frequency oscil-



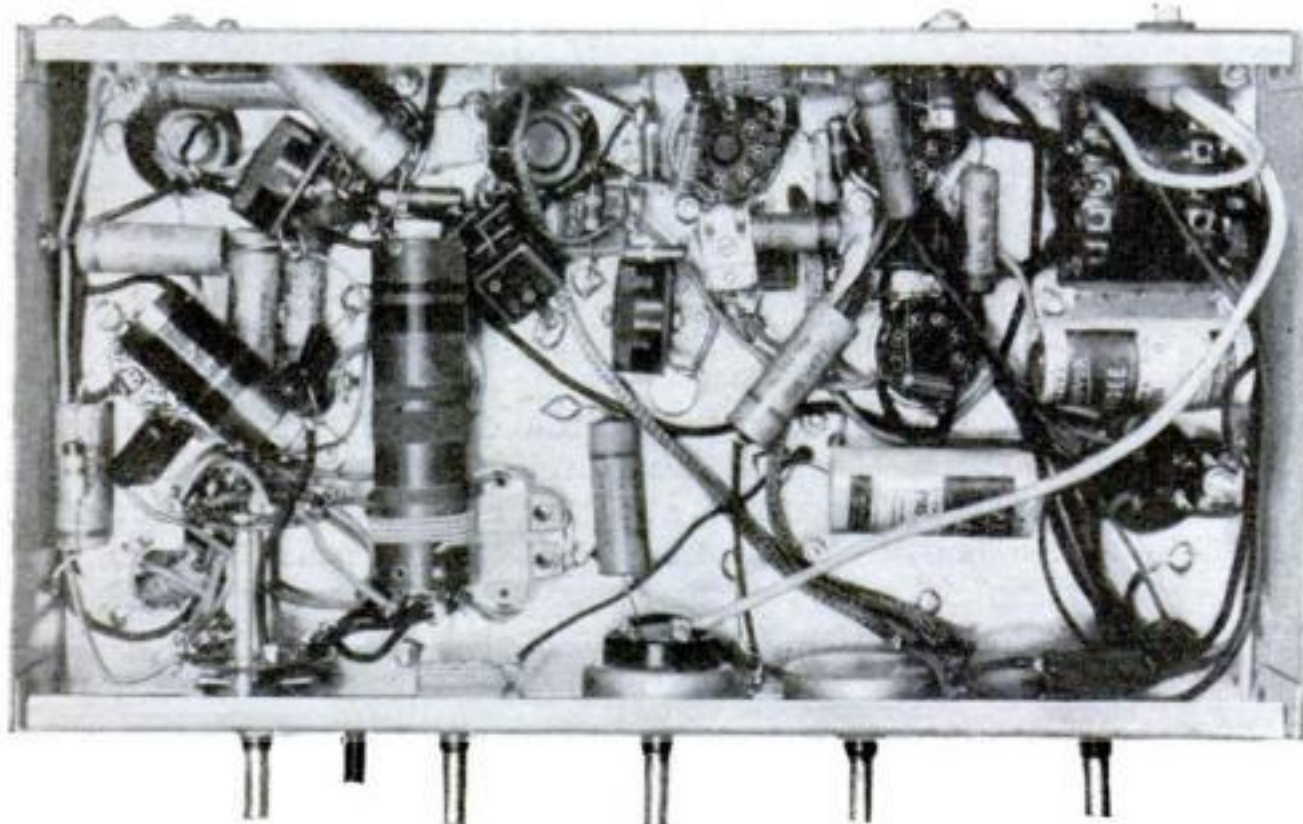
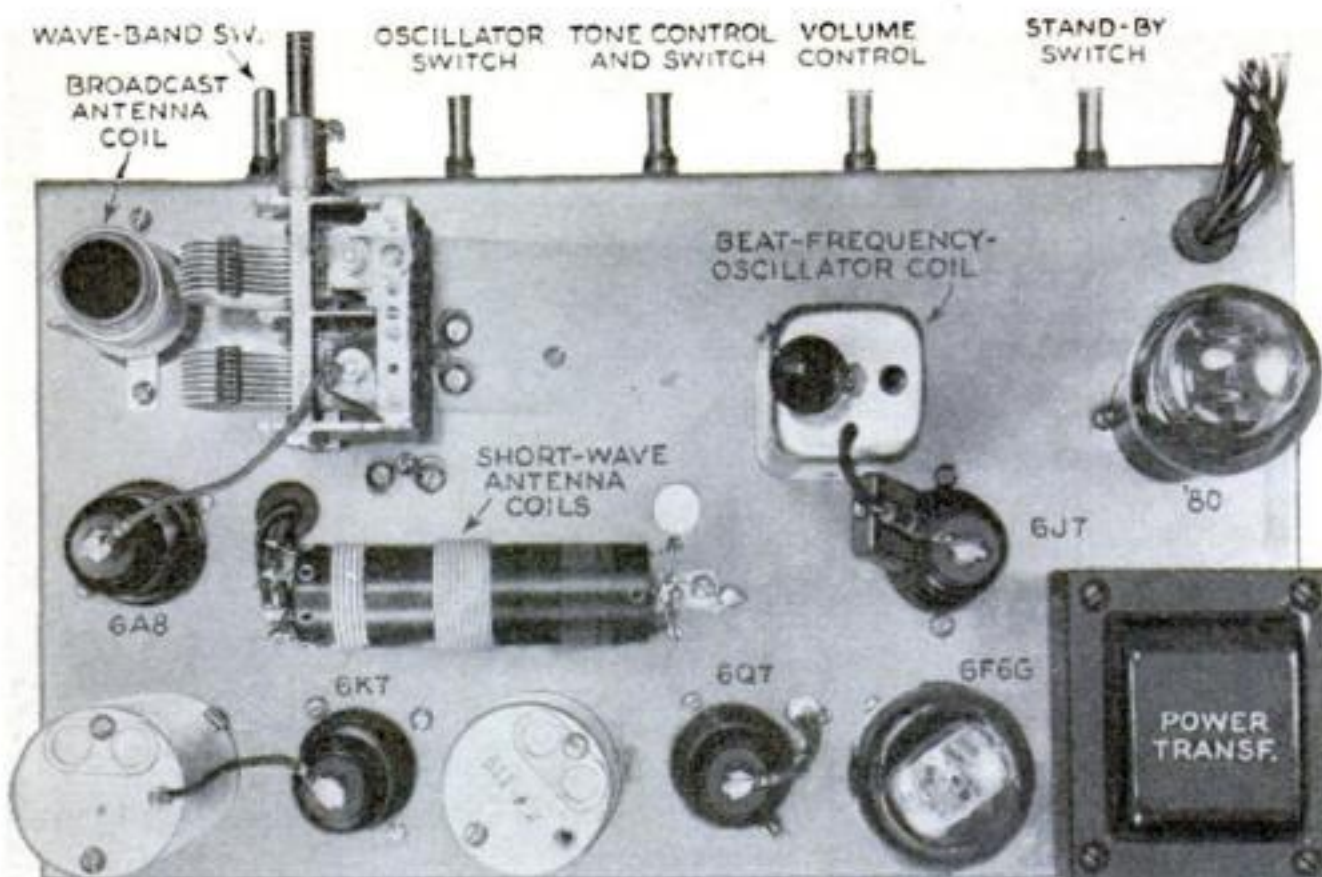
The set includes many of the outstanding features of the latest models

lator with pitch control and on-off switch, automatic volume control, a full-range tone control, and provisions for the use of either a doublet or L-type antenna.

No band spread has been used in the original design as satisfactory results were obtained by the small friction-drive vernier



COMPLETE WIRING DATA
for the circuit and the tubes are given in the diagrams at the left and above. A supersensitive band spread is shown in dotted lines



dial shown next to the outer rim of the large tuning dial. Most readers will find this system sufficient for their needs, especially as this vernier control costs only ten cents! However, those who wish to add an electrical band-spread system may do so. It involves only a slight additional cost of from one to two dollars, and consists merely of wiring a two-gang tuning condenser having a very low maximum capacity (approximately fifteen micromicrofarads) across the main two-gang tuning condenser as shown by dotted lines in the diagram. It can be mounted between the speaker and main tuning control. This system is used only for the short-wave bands and becomes inoperative on the broadcast band.

All-metal tubes are used in all stages but the last. In this stage (the output or second audio amplifier) an

PARTS FOR THE COMMUNICATIONS RECEIVER

All-wave coil kit.

Two-gang tuning condenser, 15 mmfd.

Two-gang tuning condenser, 15 mmfd (see text).

Beat-frequency coil.

One 4-prong and five octal wafer sockets.

Tone control, 50,000 ohm; and switch.

Volume control, 500,000 ohm.

S.P.S.T. rotary stand-by switch.

Five-inch dynamic speaker, 2,750 ohm.

Power transformer.

Two radio-frequency chokes, 2.5 mh.

Padder condenser, 3-30 mmfd.

Two carbon resistors, $\frac{1}{2}$ meg., $\frac{1}{2}$ watt.

Carbon resistor, 1 meg., $\frac{1}{2}$ watt.

Carbon resistor, 250,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 200,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 100,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 50,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 25,000 ohm, 1 watt.

Carbon resistor, 10,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 15,000 ohm, 1 watt.

Carbon resistor, 3,000 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 500 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 400 ohm, 1 watt.

Carbon resistor, 300 ohm, $\frac{1}{2}$ watt.

Carbon resistor, 200 ohm, $\frac{1}{2}$ watt.

Five tubular condensers, .1 mfd., 400 volts.

Five tubular condensers, .05 mfd., 400 volts.

Tubular condenser, .01 mfd., 400 volts.

Three mica condensers, .0005 mfd.

Three mica condensers, .0001 mfd.

Two electrolytic condensers, 12 mfd., 450 volts.

Electrolytic condenser, 10 mfd., 25 volts.

Mica condensers, .003 mfd., and .0016 mfd. (included in coil kit).

Converter tube, 6A8.

Amplifier tube, 6K7.

Amplifier tube, 6J7.

Detector-amplifier tube, 6Q7.

Power-amplifier tube, 6F6G.

Rectifier tube, 80.

Dial, 4-inch, with vernier attachment.

Vernier dial, 3-inch (see text).

Miscellaneous: Five dial knobs; aluminum panel and chassis, phone jack; wire.

octal glass tube is used. The same thing applies to the 80, or rectifier, tube.

The purpose of the beat-frequency oscillator is to introduce oscillation into the intermediate-frequency stage so that when tuning to weak or distant stations they will not be missed. With this oscillator in operation, a slight whistle is heard each time a station is passed, much the same as that heard when tuning a one or two-tube receiver with the regeneration control full on.

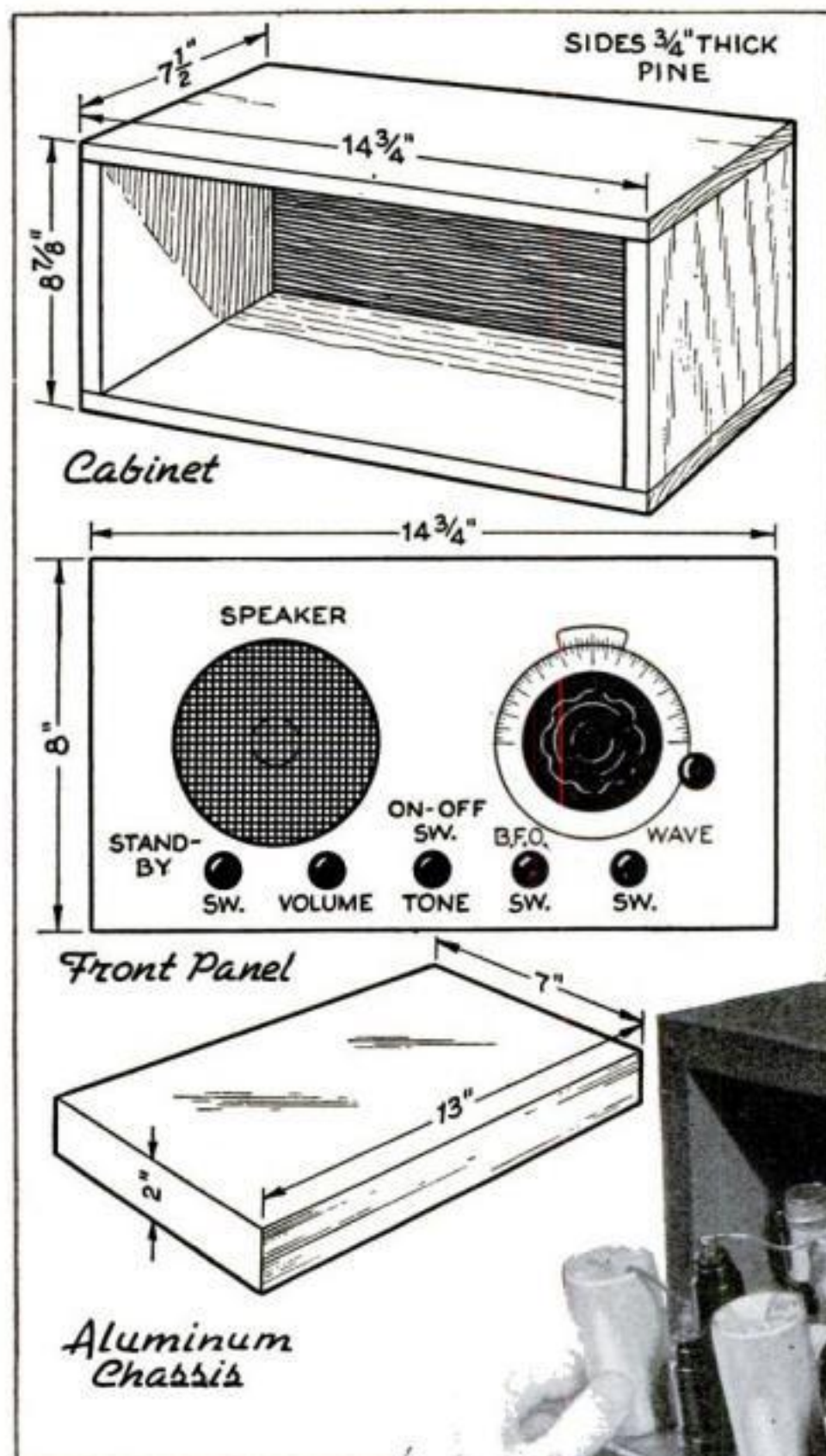
Another helpful feature is the stand-by

switch. This control cuts out the plate and screen voltages and silences the set but does not disconnect the heaters of the tubes so that the set can be switched back into immediate operation without any waiting for the tubes to heat up.

The intermediate-frequency transformers are of the tuned-grid, tuned-plate type, and are adjusted to the proper frequency before leaving the factory. This adjustment allows for normal stray capacities found in the average receiver, and, unless excessive capacities are introduced such as grid-wire shielding, only a slight touch of the trimmers is necessary to align the intermediate-frequency amplifier. However, an oscillator should be used to align the set on the short waves. This will be done for a nominal sum by your local radio service man.

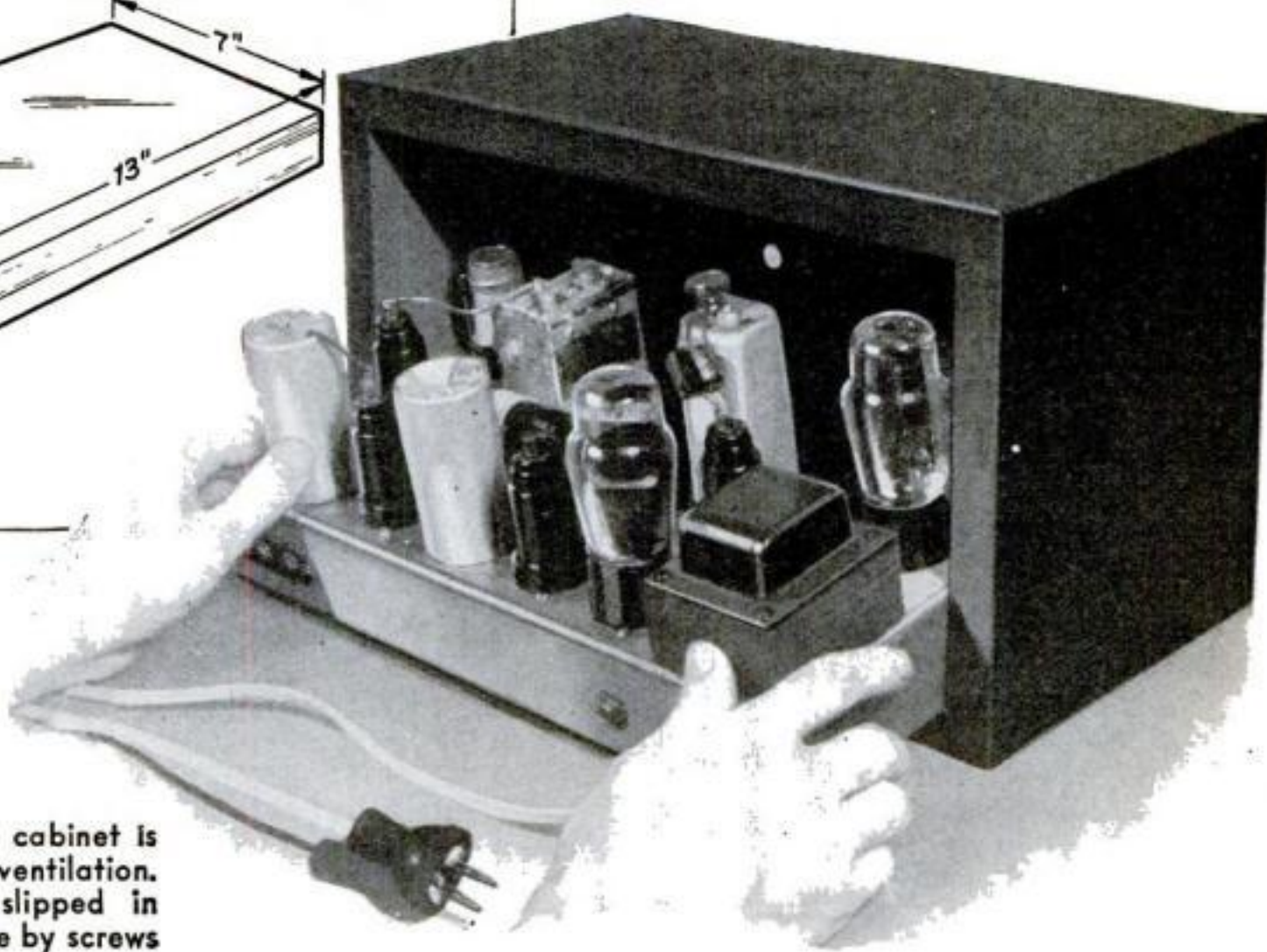
The cabinet for this set should not cost more than fifty cents and is easily built at home. It is made of white pine three quarters of an inch thick and consists of only four sides, with no front or back. As the aluminum panel overlaps the chassis in length, it will prevent the chassis from sliding in too far, and at the same time provides a means of anchoring the whole set firmly in the cabinet by means of screws at each end of the aluminum panel. The back of the cabinet is left open to provide adequate ventilation for the tubes.

To give a dressier appearance to the control panel, apply a coat of brown, crackle-finish lacquer.



Cabinet, panel, and chassis dimensions and arrangement of controls should be followed closely

The back of the cabinet is left open for ventilation. The chassis is slipped in and held in place by screws



SIX NEW HELPS

Volume-Control Replacement Kit

MATERIALS for replacing any part or all parts of the volume-control unit of more than 400 different makes of radio receivers are contained in the handy kit at the right. Not only are variable resistors of various sizes and values included, but also assorted shafts, adapters, and couplings to fit practically every radio made.



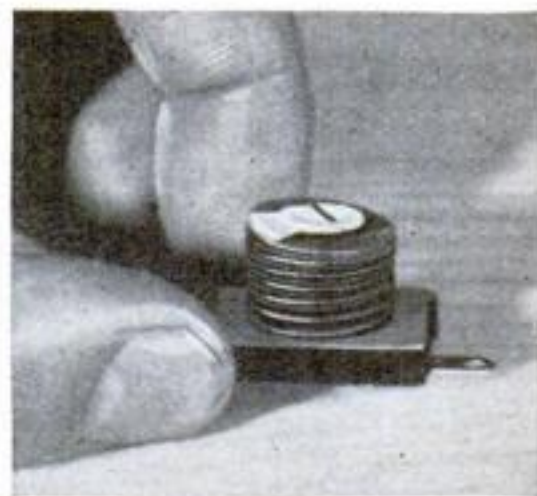
With this kit you can repair the volume control in any receiver

New Radio-Tube Tester Works Automatically

WITH a built-in filing-card index, a new tester automatically adjusts itself to show the condition of any receiver tube. After a perforated card is placed in a slot, the tube is placed in the testing socket and a lever is pulled. This causes electrical contacts to be made through the card's perforations and the tube's condition is registered on a direct-reading meter. The card to be used depends on the type of tube to be tested.

Tiny Air-Spaced Trimmer Condenser

EMPLOYING a novel principle of construction, a tiny air-spaced trimmer condenser of British design measures only 1" by $\frac{3}{4}$ " at its base. Both the moving and fixed vanes are cut in the form of a continuous spiral. The fixed spiral is permanently fastened around a composition center post. The moving spiral screws into the fixed one on a thread cut into the center post that prevents the vanes from coming in contact with one another. Thus, when an adjusting screw at one end of the movable spiral is turned, the capacity of the condenser is altered. At its minimum capacity, the idle portion of the moving vane compresses to save space.



Note the air-spaced trimmer condenser's small size. Sketch shows how it works

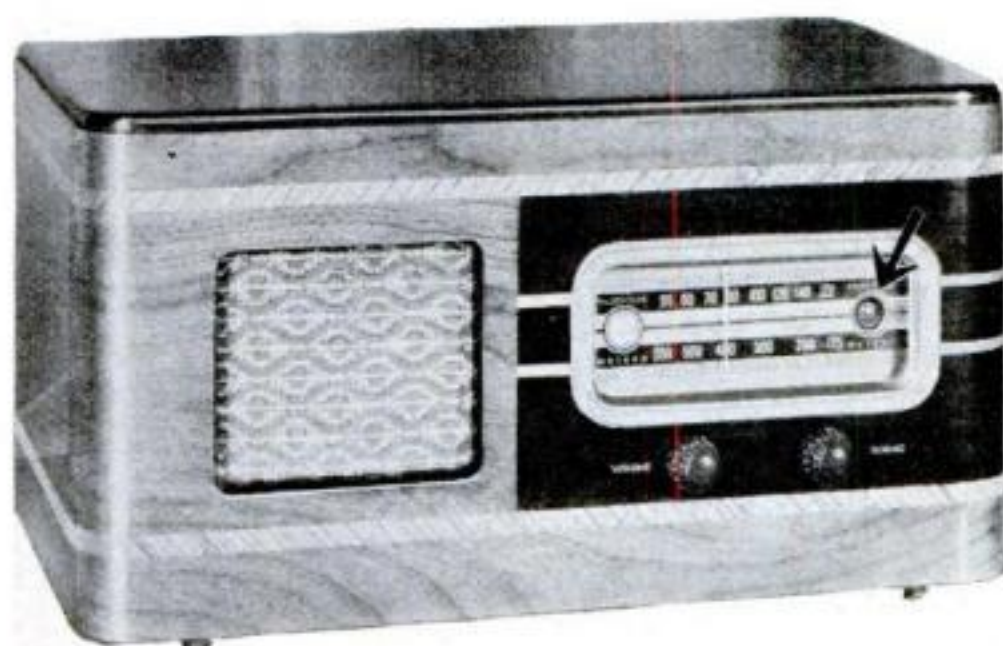
FOR RADIO FANS

Matched Units for Radio and Phonograph

INSTEAD of being built as a single unit, a new two-unit radio-phonograph combination does additional duty as a pair of end tables for a sofa. In one table is an all-wave receiver. In the other is a record-playing unit that literally broadcasts by radio the records it plays to the receiver in the other table, or to any other set located in the same room or elsewhere in the house.



The end table at left holds a radio; at right, a wireless record player



Blinker Light Shows If Battery Set Is On

REQUIRING so little current that it would take 230 years to consume the total power stored in the batteries of a portable radio in which it is used, a neon-type pilot light that shows when the radio is turned on is a feature of a new battery-operated set. Besides serving as a telltale, the "blinker" also shows when the battery voltage drops below the minimum required for its operation.

Radio-Test Laboratory on Wheels

FOR testing the quality and intensity of its transmitters' signals in various regions, the Columbia Broadcasting System has equipped the sedan shown at the right with special apparatus that permits its engineers to make quick check-ups at any point that can be reached by car. The two finlike plates on the roof are "compensators." Their purpose is to counteract any effect of the all-metal body on radio signals reaching the antennas: one a loop for broadcast reception, the other a dipole for ultra-high-frequency reception.

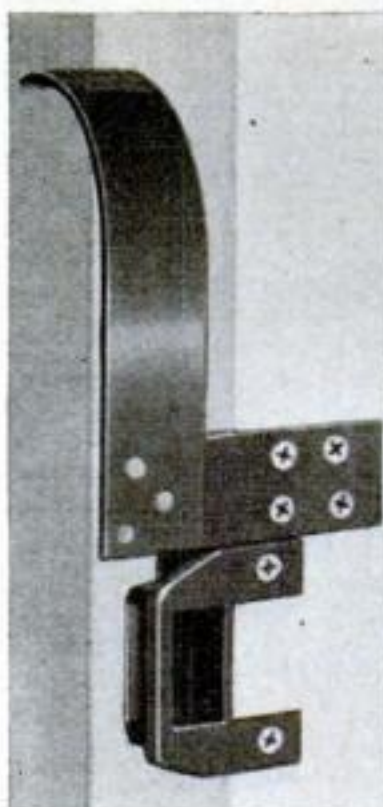


Radio signals can be tested wherever this car can drive

Hints for Car Owners

Striker Plate Adapts Latch to Overhead Garage Door

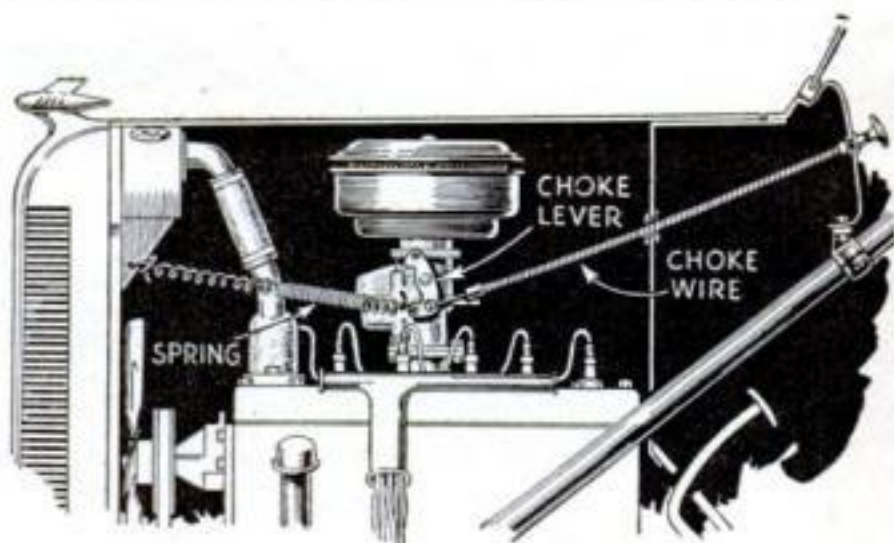
A REGULATION door latch may be adapted for use on an overhead-type garage door by the simple expedient pictured in the photographs at the right. The metal section of the lock into which the latch bolt fits is fastened to the door jamb, and above this an easily made, curved striker plate shaped from $1\frac{1}{2}$ " by $\frac{1}{8}$ " steel is installed end-wise, as pictured. The latch case is then positioned on the door itself. As the door descends, the latch will contact the edge of the steel striker and be forced inward to clear the top side of the metal receptacle into which it slides. When the door has been pulled down all the way, the latch bolt is then free to slide into place as on an ordinary swinging door.—W. O. W.



How the striker plate works. Easily shaped from steel, it depresses the latch as the overhead garage door is lowered

Choke-Rod Return Spring Aids Forgetful Drivers

IF YOU find that you sometimes run your car with the choke button partially out, forgetting to push it in after a cold-weather start, try attaching a spiral spring between the carburetor choke arm and a convenient spot on the radiator shell. Then adjust the spring tension so that the car vibration will joggle the spring and cause it to reopen the choke.—C. R. H.



Spring tension returns the choke if you forget it

Garage-Wall Mark Shows Backing Limit



The line shows the driver he has backed far enough

BECAUSE I use the extra space in the rear of my garage for storing things, I have to know exactly where to stop my car when I back it in. A few rear-end bumps convinced me that I could not trust my sense of distance, so, with the car in the right position, I painted a vertical line on the side wall of the garage opposite my head as I sat in the driver's seat. Now I back the car in with confidence, knowing that I have only to stop when my head comes even with the line.—L. H.



← **OUTDOORS
IN SUNLIGHT**

*...and it's hard to say
which is better*

**INDOORS
AT NIGHT** ↓



NIGHT SNAPSHOTS SIMPLE AS A-B-C with **KODAK SUPER-XX FILM**

EVEN in the hands of a beginner, Kodak Super-XX Film, four times as fast as ordinary film, gets excellent indoor snapshots under Photoflood lamps. The pictures come out every bit as good as though they had been taken outdoors under a

summer sun. To give outdoor excellence to your indoor snapshots, use Kodak Super-XX always. (You don't need an expensive camera to make snapshots indoors after dark; you can use any one at all that takes Super-XX, even a \$1 Brownie.)



**A ... Load your
present camera with
Kodak Super-XX Film**

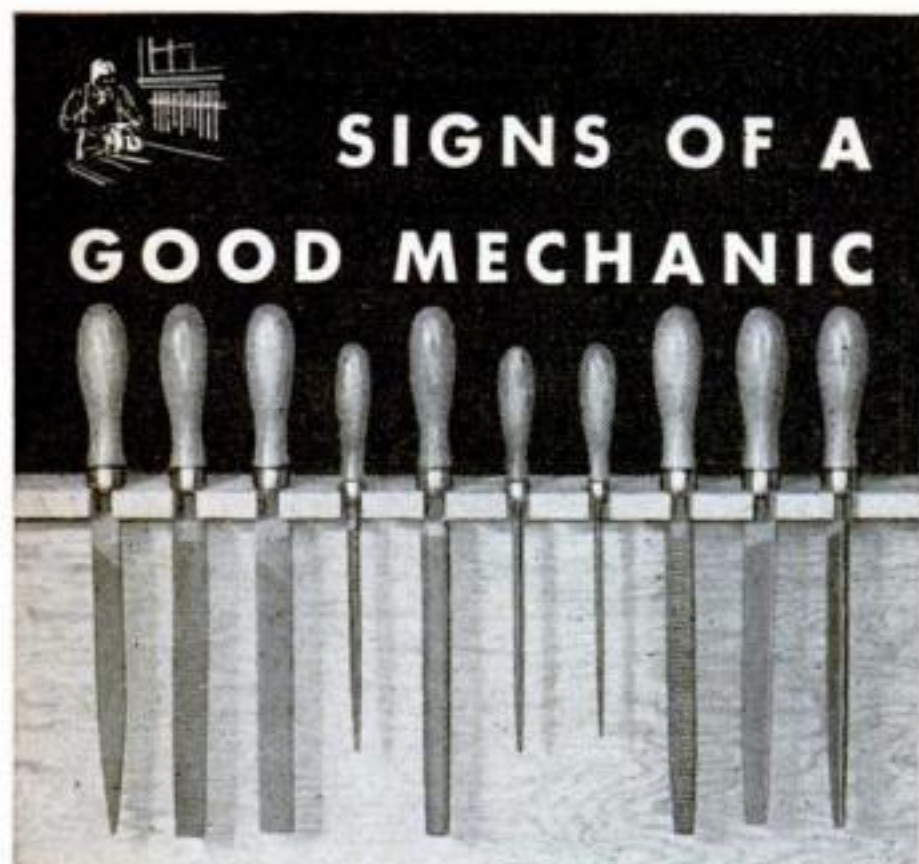


**B ... Use a couple of
inexpensive Mazda
Photoflood lamps in
Kodak Handy Reflectors**



**C ... Follow the few simple
directions in the FREE Booklet**

A few minutes with this helpful booklet and you're headed for splendid nighttime snapshots. Photos, diagrams, easy-to-understand directions. At your dealer's ... Eastman Kodak Company, Rochester, N. Y.



ARE you a "hobbyist," model maker, or master of a metal-working trade? Then you're one who recognizes the absolute need of good tools to do good work. There's little difference between the cost of hit-or-miss-quality files and Nicholson (or Black Diamond) Files. But there's a world of difference in results—and satisfaction!

Push a Nicholson double-cut flat file across a piece of metal that needs a lot of stock removal, and see it bite in like a hungry pup's fangs whittling down a bone. See, too, how it holds to the line like a keen-edged skate-runner! All due to exclusive (patented) serrated tooth construction*—and to Nicholson's tough hardness and other superfine qualities! Or, lay a Nicholson single-cut mill File onto a piece of precision work and note its sweet-cutting performance!

A popular work-bench assortment of Nicholson or Black Diamond Files will prove a prized possession. Your hardware dealer can supply you.

*Special-type serrations (left) give Nicholson and Black Diamond File teeth successive new cutting edges—assuring longer cutting efficiency. Ordinary file teeth shown at right.



FREE
28-page Book
on Filing

Write for your copy. Tells how to select, use, take care of files. Use the coupon.

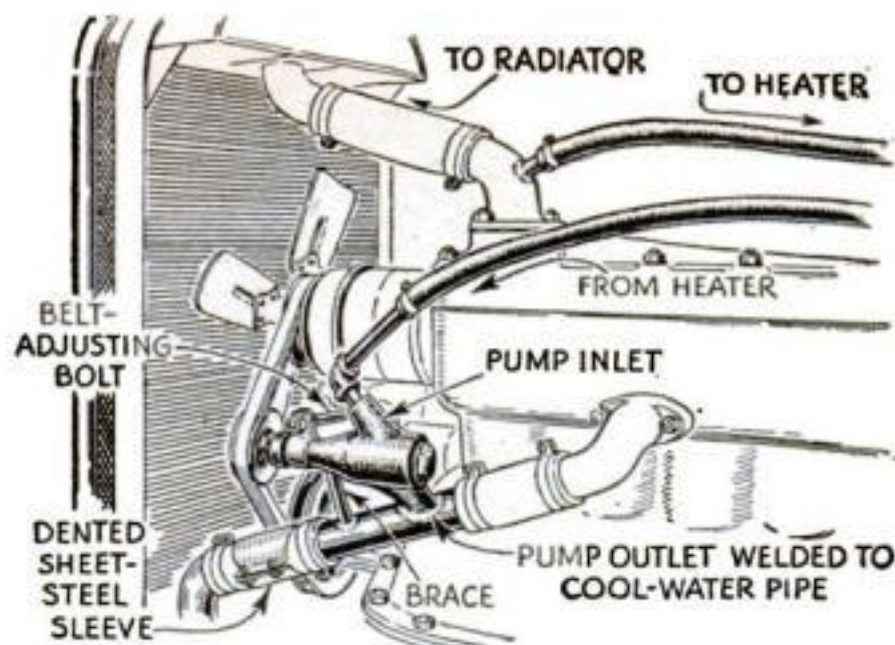
NICHOLSON FILE CO.
19 Acorn St., Providence, R. I.

Send free book, "A File for Every Purpose."

Name _____

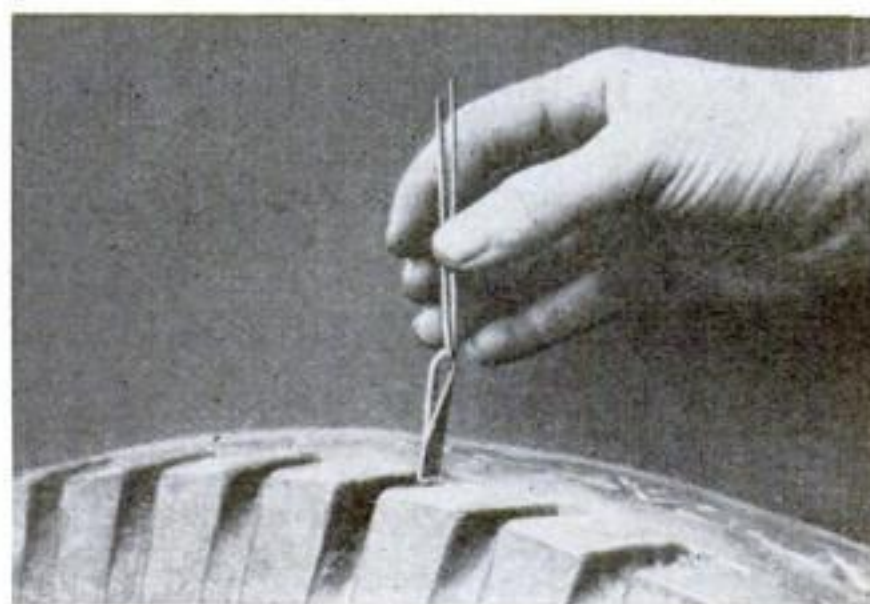
Address _____

NICHOLSON
FILES FOR EVERY
PURPOSE



Hot-Water-Heater System Uses Separate Pump

IN SOME cars having a thermosiphon water-cooling system, a hot-water heater can be made to work by installing a water pump as shown above. I purchased a second-hand automobile water pump, removed the outlet and intake extensions, and welded the outlet pipe to the car-radiator intake pipe. A small nipple was then welded to the pump intake and the hose from the car heater attached. A supporting piece of iron was next welded between the pump and the cold-water pipe for the sake of rigidity, and a V-type pulley substituted for the flat-type on the pump, over which the fan belt runs to drive the pump shaft. To increase efficiency, a thermostat was placed in the upper radiator-hose connection.—L. J. L.



Strips of Rubber Plug Holes in Tire Casings

NAIL holes in a tire casing can be sealed with a strip of inner-tube rubber cut thin at the center and wider than the hole at the ends. Sanded and then saturated with rubber cement, the strip is pulled through the hole with a loop of thin wire, stretching it into place. Trim the projecting ends, and place a patch over the inside.—A. H. V.



Atlas F-SERIES 10" LATHES

Power Cross Feed Standard Equipment

Whatever the Job... These Features Help You Do It Easier and Better!

You buy a lathe with definite things in mind: Precision workmanship—simple, convenient operation and complete versatility—dependable, long-life construction. And price is usually important. In all these respects you'll find experienced machinists advising—"Get the modern Atlas." Here are some of the reasons why:

Power Cross Feed standard equipment. Atlas is the only popular-priced lathe giving you this feature that saves much laborious work on facing operations.

Precision-Ground Bed—first essential of a precision lathe. All six Atlas bearing surfaces are aligned to within .001 in all planes.

Custom-Bored Spindle Bearings positively aligned by boring each bearing after the headstock has been fitted to the bed.

Backgeared Power—Complete V-Belt Drive—Wide Screw-Cutting Range—Quick-Change Countershafts—Rugged Zamak Alloy Parts—at no extra cost.

Sensible Prices. The 10" horizontal countershaft model above is \$104.75 complete as shown less motor—with vertical (attached) countershaft only \$99.75.

Whatever the job, you can do it easier and better with an Atlas Lathe. See them at your dealer's or send coupon below for 1940 Catalog.



"Rugged, powerful, accurate, versatile" say shop men everywhere.



"It's a real money-maker," report garages and service men.



Factory men write, "It's ideal for small part precision work."

ATLAS PRESS COMPANY

255 N. Pitcher St., Kalamazoo, Mich.

NEW YORK
130 W. 42nd St.

CHICAGO
35 E. Wacker at Wabash

PHILADELPHIA
113 N. Third St.



ATLAS PRESS COMPANY

255 N. Pitcher St., Kalamazoo, Mich.

Please send 1940 Catalog on ☐ 10" Metal Lathe ☐ 6" Metal Lathe ☐ 7" Metal Shaper ☐ Drill Presses ☐ Arbor Presses and the name of nearest Atlas Dealer.

Name.....

Address.....

City and State.....

SEND FOR THIS
FREE 204
 PAGE
RADIO
 AND PARTS
CATALOG
See AMERICA'S Most
AMAZING RADIO VALUES!

Dealers, Servicemen, Amateurs, P.A. men, Builders save money on every radio need! This famous catalog brings you Everything in Radio at lowest prices!—sets, parts, kits, tubes, tools, ham gear, P.A. systems, phonographs, recorders, test equipment—over 15,000 items! Save money on every order! **FREE—SEND COUPON!**



Choose from 60 Models!

A set for every need at great money-saving prices—60 different models, 4 to 12 tubes, with newest features, "Air-Magnet," etc., at lowest prices—with biggest values in electric phonographs, phono-radios, etc. All shown in ALLIED's big 1940 catalog—Send coupon!



REVOLUTIONARY NEW P. A. SYSTEMS!

Remarkable values in P.A. systems for every need—14 sensational new systems, "Economy," "Standard," "De Luxe," 6 to 70 watts. Also latest accessories, complete recording equipment, etc., at lowest prices—in ALLIED's Catalog. New Time Payment plan!



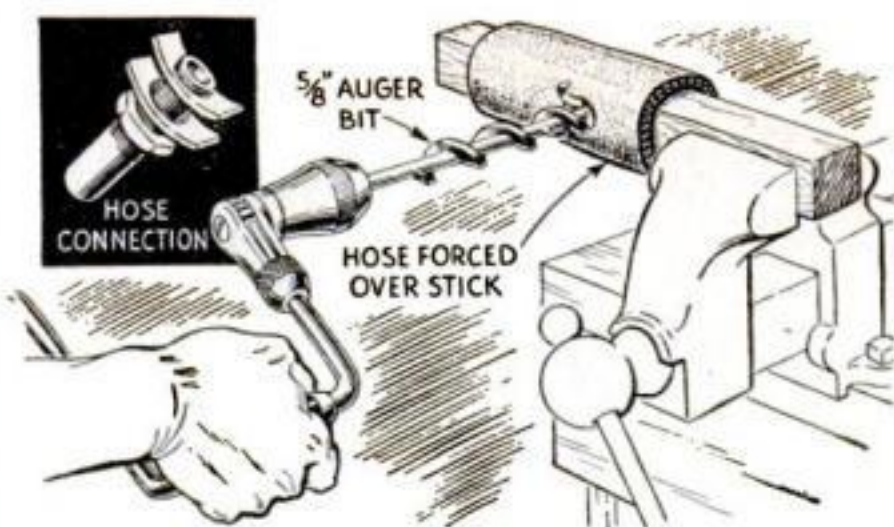
**Learn
Radio**

**BUILD YOUR
OWN
WITH ALLIED KITS**



Build your own radio receiver, transmitter, transceiver—learn while you build! Dozens of new, low-cost, easy-to-build Kits are shown in ALLIED's Catalog. We supply Free, matched Parts Lists to build any circuit. Learn Radio quickly—enjoy this great hobby! ALLIED helps you learn easily!

Send for **RADIO BUILDERS' HANDBOOK**—A beginner's book on radio; tells how to select circuits, read diagrams, build sets, etc. Easy to understand. Packed with helpful data. New revised edition. Only **10c**
 Order by coupon below



Wooden Core Simplifies Drilling Hole in Hose

HOLES for hot-water car-heater connections can easily be made in radiator hose by pushing a piece of wood into the hose as shown above, and then drilling with a wood bit of the proper size. The wood should be thick enough that the bit tip will not penetrate the opposite side of the hose.—W. E. L.



Battery Hydrometer Used as Graphite Spray Gun

AN OLD bulb-operated hydrometer, or battery tester, makes a good spray gun to apply graphite for lubricating purposes to metal joints, locks, or hood webbing on a car. Remove the float and clean the battery tester with soda or some other alkaline agent to neutralize any acid that may remain. Rinse it out with clean water, let it dry, then fill it part way with graphite powder.—R. J. H.

Temporary Hose Repair

TO MAKE an emergency repair on a leaking radiator-hose connection, cut a long strip about an inch wide from an old inner tube, and wrap the strip in a spiral around the leaking section, applying some tension as you make the wrapping. Then wrap this spiral with adhesive tape, working back over the section in the opposite direction. The tape itself thus is kept from getting wet and losing its adhesive properties.—S. R.

ALLIED RADIO

ALLIED RADIO CORP.
 833 W. Jackson Blvd., Dept. 7-B-0
 Chicago, Illinois

- ☐ RUSH your FREE 1940 Radio Supply Catalog.
☐ ENCLOSED find 10c. Send your NEW Radio Builders' Handbook.

NAME _____

ADDRESS _____

CITY _____ STATE _____

**CATALOG
FREE**
 Send this
 Coupon!

WHEN YOU'RE
SHOOTIN' FOR FLAVOR
LIGHT UP WITH

Velvet



LOU HUTT
Ace Newsreel
Cameraman

...the MILDNESS
of fine old Kentucky Burley
tobacco, aged in wood.

... the FLAVOR
of pure maple sugar for ex-
tra good taste.

Packs easy in a pipe
rolls smooth in a cigarette
better tobacco for both.

*for Better
Smoking
Tobacco*

—say VELVET!

Copyright 1940, LIGGETT & MYERS TOBACCO CO.

FEBRUARY, 1940

Please mention POPULAR SCIENCE MONTHLY when writing to advertisers.

225

Copyrighted material

SHORT CUTS FOR THE HOME CRAFTSMAN



How to "antique" a piece of furniture

● A Carborundum Brand Garnet Abrasive Sleeve fitted to a drum rotated by flexible shaft becomes, if anything, even more useful than a disc sander.

The maker of antique furniture reproductions finds such a sanding drum a big time saver. It can be used to make almost any kind of depression in any wood. Edges and corners are easily rounded to simulate wear. And high-lighting the work after staining is a simple matter.

"Antiquing" furniture is only one job for Carborundum Brand Garnet Sleeves. They can be used in dozens of other ways to save you time, labor and money... to help you get more pleasure from your home workshop.

Ask your hardware dealer or mill supply house to show you the complete line of Carborundum-made coated abrasives, sharpening stones, grinding wheels and other abrasive products for the home craftsman. Send 20¢ coin or stamps for souvenir sharpening stone and valuable illustrated manual on how abrasive products can save time and help you do better work.



THE CARBORUNDUM COMPANY

REG. U. S. PAT. OFF.

Niagara Falls, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids
(Carborundum is a registered trade-mark of The Carborundum Company)



Order blueprint numbers 378-379-380 for this boat

PLANS AND PATTERNS for Building Our New FAMILY RUNABOUT

THERE is an enjoyable season on the water ahead of you this summer if you own a boat. Our new round-bottom, all-purpose runabout is ideal for both cruising and racing, and complete blueprints, drawn to scale, cost only a dollar. By starting construction now, you can have your boat ready before the arrival of summer.

For the benefit of readers who wish full-size heavy-paper patterns of the molds, transom, and stem, we can have them drawn to order by the designer for \$1.50. The cost of both blueprints and patterns is \$2.50. Blueprints are mailed at once, but there will be a delay of about ten days before you receive the patterns.

Blueprints for many other projects are available. A few of them are given below; a complete list will be sent upon receipt of a stamped, self-addressed envelope.

BOATS

Cabin Cruiser, 17' long, for use with outboard or inboard drives, 356-357-358-359-R.....	\$1.50
Camper's Utility Boat, 11' 2" long, canvas-covered, for outboard motor or rowing, 281-R50
Canoe, 16' canvas-covered kayak; can be used with sail, 192-193-194-R.....	1.00
Canvas-Covered Duck Boat, 13' 6" long, 279-R....	.50
Family Runabout, 13' 5½" long, weighs 275 lb., for outboards from 1 to 60 h.p.; can also be rowed (illustrated above), 378-379-380	1.00
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed, 344-345-R.....	.75
Lapstreak Skiff, 13' 9" long, weighs 225 lb., for 1- to 16-h.p. outboard motors, 363-R.....	.50
Midget Boat or Pram, 9' long, weighs 75 lb., for oars, sail, or outboard motor, 339-R.....	.50
Motorboat-Rowboat, 13' long, decked hull, for use with outboard or inboard drives, 147-R.....	.50
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged, 321-322-323-R.....	1.00
Sailboat, 12' long, weighs 200 lb.; has fast skimming-dish hull, 314-R.....	.50

(Continued on page 227)

Plans for Boat Builders

(Continued from page 226)

Sectional Rowboat, 9' 8" long, weighs 60 lb., all-wood construction; can be used with small outboard motor, 340-341-R..... .75

RADIO

All-Wave Portable Receiver, 2 tubes, battery operated, 217-R..... .50
Amateur Short Wave Receiver, 3 tubes, battery or 110-volt A.C. or D.C. operation, 155..... .25
Beginner's Battery Receiver, 365A..... .25
Full Electric Headphone Receiver (can be made compact for portable use), 130..... .25
One-Tube Receiver, battery operated, 103..... .25

FURNITURE

Double-Decker Bed, 277A..... .25
Early American Round-Top Stand, 191A..... .50
Fireside Bench, Colonial, 187A-188A..... .50
Flat Top Desk, 2' 2" by 4' 2" top (no turning,) 20..... .25
Floor Lamp, with tripod base, 243A..... .25
Four-Leaf Card or Occasional Table, 239A..... .25
Hanging Wall Cabinet, 9 1/2" by 24" by 41 3/4", 280A..... .25
Magazine Rack, ladder-back style, 250A..... .25
Silverware Chest on Stand, 256A..... .25
Smoking Stand, modern, 238A..... .25
Tea Wagon, with removable tray and drop leaves, 20" by 30" top (turning), 13..... .25
Upholstered Stool, 240A..... .25

MODELS

BLUENOSE, famous fishing schooner, 17 1/2" hull, 110-111-112-R..... 1.00
Clipper Ship GREAT REPUBLIC, 31 1/2" hull, 272-273-274-R..... 1.25
Clipper Ship SEA WITCH, 9 1/2" hull, 219..... .25
Coast Guard Patrol of 165-ft. Type, 20 7/8" hull, 286-287-R..... .75
Concord Stagecoach DIAMOND TALLY-HO, 20 1/2" long, 115-116-117-R..... 1.00
Confederate Raider ALABAMA, 21 1/2" hull, 335-336-337-R..... 1.50
Elizabethan Galleon REVENGE, 21" hull, 206-207-208-209..... 1.00
Fishing Schooner WE'RE HERE of "Captains Courageous," 9 1/2" over all, 351-R..... .50
H. M. S. BOUNTY, 8 1/2" hull, 254..... .25
Liner QUEEN MARY, 10 1/2" hull, 283..... .25
NOURMAHAL, power yacht, 8 1/8" hull, 276..... .25
Ocean Freighter, 14" hull, 271..... .25
(Construction kits are available for some of these models. Turn to page 230.)

MISCELLANEOUS

Baby's Crib and Play Pen, 26..... .25
Birds and Animals, jig-saw patterns, 56..... .25
Colonial Design Doll's House, 72..... .25
Doll's House Furniture, 73..... .25
Electric Teacher, (question-and-answer game), 302A..... .25
Microscope Kit, portable, 220..... .25
Projector for Photos and Pictures, 259A..... .25
Six Simple Block Puzzles, 65..... .25

LEAFLETS AND BOOKLETS

Home Workshop Index for 1937..... .10
Home Workshop Index for 1938..... .10
Home Workshop Index for 1939..... .10
How to Build and Operate an Inexpensive Arc Welder and Spot Welder..... .50
How to Make Your Own Marionettes..... .50
Inexpensive Photo Equipment You Can Make Yourself..... .50
Workbenches and Tool Cabinets (leaflet)..... .10

Popular Science Monthly

353 Fourth Avenue, New York

Send me the blueprint, or blueprints, numbered as follows:

I am inclosing.....dollars.....cents

Name

Street

City and State

(Please print your name and address very clearly.)



MOTORCYCLING

GREATEST OF OUTDOOR SPORTS

See what fun and thrills motorcycle riders enjoy! Own a Harley-Davidson — take in club rallies, gypsy tours, races, hillclimbs—go on wonderful vacation trips at little cost. See your Harley-Davidson dealer NOW!

HARLEY-DAVIDSON

WORLD'S CHAMPION MOTORCYCLE

FREE

HARLEY-DAVIDSON MOTOR CO.
Dept. PS, Milwaukee, Wis.

Send FREE copy of big 24-page "Enthusiast" motorcycling magazine filled with pictures and stories of exciting motorcycle doings. Also literature on new 1940 Harley-Davidsons. Stamp enclosed for mailing cost.

Name

Address

SEND COUPON NOW

Down Go PRICES!

On Fine WOODS and Craftsmen's Supplies



And what have you got against paying LESS for FINER woods? Top quality woods from all parts of the world — SEASONED and DRIED to PERFECTION! No checking! For 112 years the name CONSTANTINE in imported woods has stood for top quality just as now in the Craftsman field.

Save Up To \$15! Here's your answer to rising prices! Get our NEW 1940 Catalog and enjoy real BARGAINS! Imagine! 16 special offers on VENEERS. Save up to \$13.53! Fancy matched veneers, ideal for PLAQUE BACKS, DRESSER TOPS, DRAWER FRONTS, ART BOXES, CABINETS, TEA TRAYS, or other plain surfaces to decorate. On FACE VENEERS, save up to \$14.81!

Send For Bargain Book TODAY!

Full of surprises from cover to cover! Now, for the first time — BURL TURNING BLOCKS! Also NEW INLAY BORDERS

Catalog Tells You:

How To Work With Inlays
Everything You Want To Know About Working With Veneers
How To Make Inlay Pictures (Experts' Secrets Simplified)
NEW Kind Of Veneer Press (Build It Yourself. Save \$22.50)
How To Finish Fine Woods And Bring Out All Their Natural Beauty.

in patterns never offered before! 15 Special Offers on LUMBER and TURNING SQUARES. Save up to \$3.88! HOLLY SQUARES—save up to \$15.88! On fine VENEERS, save \$15.33! Here's your chance. . . 45 SPECIAL Offers—a carnival of bargains on extra fine woods. You may never see such woods at these bed-rock prices again. Even if you don't need woods right now, scoop up these exciting VALUES, and salt them away! Send 10¢ for catalog TODAY, and find out how much you can SAVE!

Albert Constantine & Son, Inc.
793-D East 135th St., New York

BUILD THE DESTROYER PRESTON

CARVED HULL

Included!

24" Super Detail Model

Catalog—10c.

Complete Kit

\$2.50
Post Paid

Makes perfect building easy



IDEAL AEROPLANE & SUPPLY CO., Inc., 28 West 19th St., New York



Burpee's ZINNIAS

Giant Dahlia-Flowered—

4 colors—Scarlet, Yellow, Lavender, Rose, a 15c-Packet of each, postpaid, all 4 for 10¢! Seed Catalog FREE.

W. Atlee Burpee Co., 670 Burpee Bldg., Philadelphia

4 PKTS.
10¢

MEGOW'S

MODEL AIRPLANES
Send 5c postage for new Megow Catalog! 100 pages, profusely illustrated. Shows scores of gas-powered and rubber-powered Model Airplanes. Also Ship Models, HO-Gauge and O-Gauge Railroads, equipment and supplies.

**MODEL SHIPS
HO-GAUGE
RAILROADS**

MEGOW'S Dept. PS, How. & Oxf. Sts., Phila.
217 N. Desplaines St., Chicago



A MODERN toolmaker should have a pocket-size microscope of his own. It's the only way to keep in step with the inspector.

I don't quite understand why some machine shops still rebabbitt certain machine-tool bearings every three or four weeks when a pair of radial-thrust ball bearings cost so little, compared to lost time and the setback in production.

When permissible, you can do a much better job of threading with a die, either free-hand or in a lathe, if you turn 1/2" of that end of the stock to the root diameter of the die thread. You thus get a square start, and the turned tip can then be cut off.

Ever hear of making a coil spring from cast iron? Well, it is claimed it can be done with a recently developed gray iron that has a variety of uses and can be easily hardened.

We are told that automobile-body designers first build up models of clay, plaster of Paris, and wood before making the final drawings. I know some tool and machine designers who would save the "boss" plenty if they did the same thing.

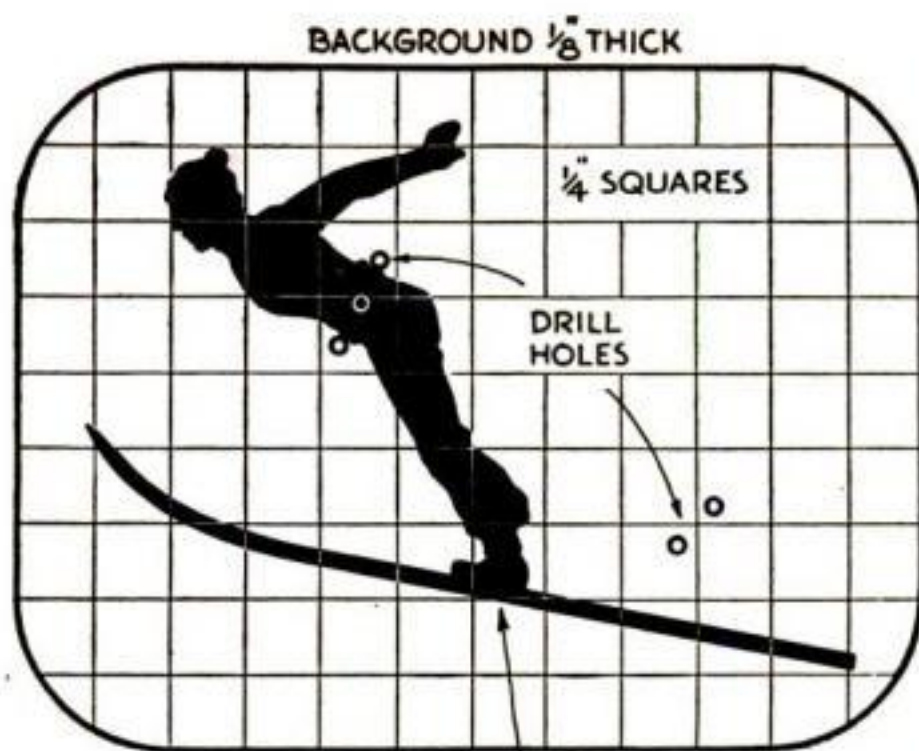
Threading dials are one of the most practical additions to lathes in years. You can readily make one for an old model lathe, and you'll enjoy both making and using it.

Each time you drill a 2" hole into a 6" length of 3" cold-rolled or carbon steel, approximately 5 lb. of material goes to the chip pile. Add the labor costs and then look at the price list of seamless steel tubing.

Old Auto Mats Reduce Fatigue in the Shop

AT GARAGES it is often possible to obtain discarded felt-backed car mats. After the worn spots have been cut out, there is usually a piece left that is large enough to throw on the floor in front of a lathe or other much-used machine. Such a mat is restful to a mechanic who is constantly on his feet.—ALLEN ZERBE.

Please mention POPULAR SCIENCE when writing to advertisers.



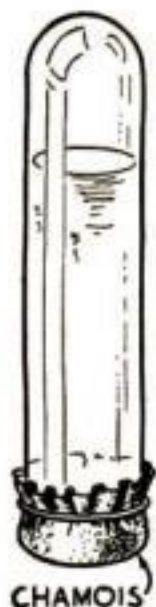
SKI JUMPER 2-PLY WOOD 1/4" THICK

Small Wooden Ski Jumper Ornaments a Snow Suit

WITH a ski jumper as the design, this little plaque makes an excellent gift for a sport-loving friend. It can be sewn on the breast pocket of a ski suit and the name of a club added in small painted letters. In sewing, use bright colored thread to represent a belt.

Cut the background from 1/8" whitewood and paint it, if desired. Make a two-ply board of the same material with casein glue and leave in a press overnight. Trace the ski jumper on the plywood and jig-saw it to shape. Glue the figure on the background with cellulose household cement or other quick-drying waterproof glue and place a weight on it until dry. Round off and carve the figure slightly by hand or with a dental burr held in a chuck. If the latter is used, a speed of 1,700 to 3,000 r.p.m. gives good results. Drill holes as indicated and finish with two coats of spar varnish.—EDWARD B. FOX.

Office Envelope Moistener Made from a Test Tube



CHAMOIS

IF A TEST tube is filled with water and covered with a piece of chamois skin as shown, it makes an excellent envelope moistener for office use. We had previously been using commercial moisteners consisting of a glass tube pinched at the end and fitted with a piece of felt. It always took a little time for the felt to become saturated, and the moisteners were hard to fill and keep from leaking. The homemade type has neither of these objections.—DUANE W. BAILEY.

WANTED: RED-BLOODED ADVENTURERS

Listen to
"SKY BLAZERS"

—true adventures of the
**Men and Women
Born to Blaze the Trails
of the Blue**

Thrilling! True! Romantic!

EVERY SATURDAY

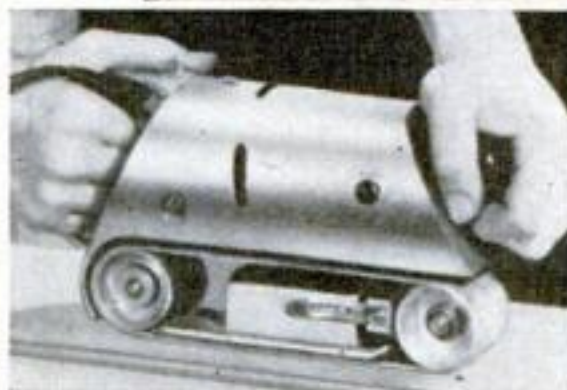
COLUMBIA BROADCASTING SYSTEM

7:30 P.M., E.S.T.—6:30 P.M., C.S.T.

7:00 P.M., M.S.T.—4:30 P.M., P.S.T.

PRESENTED BY WONDER BREAD

Guild PORTABLE
ELECTRIC **Sander**
does Those



Tough
Sanding
Scraping
Planing Jobs!

10 Times
FASTER

... and You're SURE to get an "expert" finish! Whether it's wood, metal, stone or plastics . . . whether it's a flat or curved surface . . . whether you want to sand, grind, polish, buff, remove paint or varnish, or sharpen tools—let GUILDSANDER help you! It's light-weight, easily portable—yet it's solidly made by sanding machine experts!

Even an inexperienced user is sure to get a clean, smooth, "expert" finish, because the high speed endless abrasive belt leaves no swirls, no scratches!

GUILDSANDER soon pays for itself by helping you to do MANY tedious, difficult, disagreeable jobs 10 TIMES FASTER—and a hundred times easier—than can be done by hand! Try out GUILDSANDER for yourself—or write direct for price and full information, also names of nearest dealer.

Weights only 8 lbs.
AC or DC
Universal Motor
Quality Guaranteed
POPULAR PRICE

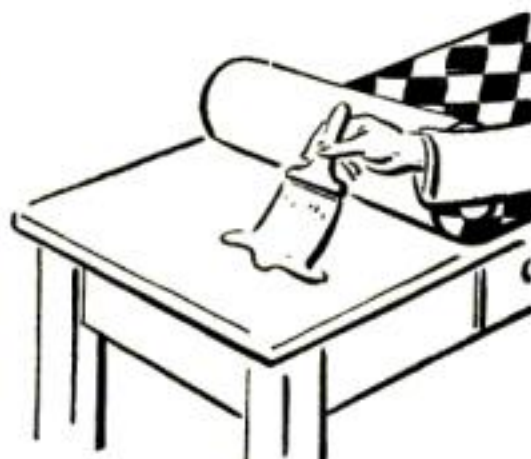
SYRACUSE GUILD TOOL COMPANY
1740-26 No. Salina St. Syracuse, New York



Linoleum top converts table for practical kitchen use!

Size table top with one coat of CASCO. Sand when dry. Apply second coat and roll or iron linoleum or oilcloth onto top.

For details, send coupon below for free CASCO GLUING GUIDE. Gives dozens of practical household gluing hints.



Here's *one* glue that does *many* jobs! Because you mix CASCO, you can mix it to just the right consistency for *any* materials—and make joints that resist heat, moisture, rough handling.

CASCO is easy to use. No heating. No mess. Just add water and mix. You get the same clean, easy-spreading glue that leading furniture manufacturers and wood-workers use for *permanent* joints. 10¢ to 65¢ at hardware stores.

NEW ODD-JOB CEMENT

Used by big industries, now in handy tubes for home, school, office. Sticks wood, felt, fabric... to metal, plastics, glass. Doesn't "gum" on fingers. Large tube, 25¢ at hardware stores.



FREE Handy Workshop Folders

CASEIN COMPANY OF AMERICA, Dept. PS-240
350 Madison Avenue, New York, N. Y.

Please send me free folders checked below:

- ☐ HOME WORKSHOP HANDBOOK. Tells where to get free and low-cost booklets on every workshop subject.
- ☐ GLUING GUIDE. Complete gluing directions and 70 successful home uses for CASCO GLUE.
- ☐ PROJECT FOLDER. Descriptions of 24 popular projects available in plan form to CASCO users.
- ☐ CASCO FLEXIBLE CEMENT FOLDER. Directions, suggestions for home, school and office.

Name _____

Address _____

-----Save 2c. Stick coupon on penny postcard-----



Craftwork Kits for Building WARSHIP MODELS

Kit E
Battleship 36" long

CLEAR the decks of your workbench and transform it into a miniature shipyard. You'll have loads of fun building models of battleships, destroyers, and other ships. Our construction kits contain all the raw materials and instructions for making a wide variety of vessels. The complete list follows:

STANDARD SHIP MODEL KITS

- | | | |
|------|-----------------------------------------------------------------------------------------|---------|
| A. | Whaling ship WANDERER, 20½" hull, 27" over all..... | \$7.40* |
| D. | Spanish galleon, 24" hull, 30" over all..... | 6.95* |
| E. | Battleship U.S.S. TEXAS, 3' long..... | 7.45* |
| G. | Elizabethan galleon REVENGE, 25" hull, 28" over all..... | 7.25* |
| L. | Farragut's flagship HARTFORD, steam-and-sail sloop-of-war, 33½" hull, 41" over all..... | 8.45* |
| Q. | Privateer SWALLOW, a Baltimore clipper, 12½" hull, 20" over all..... | 4.95† |
| V. | Clipper SOVEREIGN OF THE SEAS, 20½" hull, 26" over all..... | 4.95† |
| Y. | Trading schooner, Maine type; 17½" hull, 22½" over all..... | 4.90† |
| 2S. | U.S. Navy destroyer PRESTON, 31½" long | 5.95* |
| 3S. | CONSTITUTION ("Old Ironsides") 21" hull, 31" over all..... | 6.50* |
| 4S. | Clipper ship GREAT REPUBLIC, 31½" hull, 42" over all..... | 8.40* |
| 5S. | Coast Guard Patrol of 165-ft. type, 20⅝" long..... | 4.95* |
| 6S. | Brig MALEK ADHEL, 20" hull, 33" over all; frame-and-plank construction..... | 9.75† |
| 8S. | Fishing schooner BLUENOSE, 17½" hull, 22" over all..... | 4.95† |
| 9S. | New Bedford whaleboat, with complete equipment, 14" long..... | 2.75† |
| 10S. | Confederate raider ALABAMA; steam sloop, bark rigged; 21½" hull, 28" over all | 8.20* |

(Continued on page 232)

A model of the Navy destroyer "Preston" made with our Kit 2S



Get The INSIDE FACTS Before You Buy Power Tools



If you are interested in power tools for your workshop—there are vital inside facts you simply *must* know before you can make a sound decision. These facts are now available to you in the

New 1940 Delta Catalog

which not only lists the complete line of Delta "Quality" power tools—but shows you the important points to look for in all power tools. It explains the advantages of "diamond-boring" of bearing seats, "pre-loading" and correct mounting of ball bearings and "sealed-for-life" ball bearings. It illustrates many hidden features of design and construction that make for long, better service in power tools. It takes up the major power tools one by one and analyzes various types of design and shows the advantages and disadvantages of each design. It shows you the features you should look for in selecting power tools for your shop. Truly this new 1940 Delta Catalog is A BUYER'S GUIDE—crammed with useful information that every craftsman should have. Send the coupon for your FREE copy (also send 10c for the new Project Book No. 6, containing working drawings and instructions for many new and "out of the ordinary" things to make).

New Time Payment Plan

This Delta Tilting Arbor Saw is but one of the many power tools that typify Delta extra value and extra quality. It embodies numerous features and advantages described fully in the new 1940 Delta Catalog and here's good news—the complete line of Delta metal and woodworking tools is now available on liberal extended terms through Delta dealers. Send for details.

DELTA MFG. CO.

600-634 EAST VIENNA AVENUE
MILWAUKEE, WISCONSIN

Delta Mfg. Co., Dept. B-240
600-634 E. Vienna Ave., Milwaukee, Wis.
Send me the latest new 1940 Delta Catalog and list of Delta Dealers nearest me. ☐ I enclose 10c (stamps or coin) for which please send me the new Delta Project Book No. 6.
Name.....
Address.....
City.....State.....
☐ check here if you are a Delta user now.

Earn \$150 to \$300 PROFIT monthly with new Arc Welding

30 DAYS TRIAL

at Hobart's risk
and easy "Pays
for itself" Terms

"BUILD YOUR OWN" Arc Welder

Couple your own engine to this unit on a used auto chassis and you have the money-making advantages of a portable welder at a saving of \$300 to \$500.

Now you can start a profitable welding business and easily clear \$150 to \$300 every month. With present low prices arc welding is now made available to you at little cost, and with this equipment it's easy to get the profitable big pay jobs. Hobart Arc Welders are simple to operate, faster welding with that extra capacity and guaranteed to bring quality welding business.

LET YOUR WELDER PAY FOR ITSELF

You can own your welder with practically no expense to you. The extra profit on a single job is usually more than enough to take care of the small monthly payments. You can even rent a new Hobart and later purchase it without loss.

FREE! BOOKS ON
ARC WELDING
Check Coupon

- ☐ How to "Build-Your-Own"
- ☐ New Profits in Arc Welding
- ☐ New Arc Welding Cat.



Gas Engine Drive



Electric Drive

HOBART

The Fastest Selling Arc Welder on the Market Today

HOBART BROS., BOX P-2401, TROY, OHIO

Send me information without obligation on ☐ Build Your Own Welder
☐ Electric Drive Welder ☐ Gas Drive Welder ☐ 30 Days Trial, Easy Terms.
Send me free books I've checked.

Name.....

Address.....



P. W. REPAIRS FURNITURE

Plastic Wood handles like putty—hardens into lasting wood. Makes quick, yet permanent repairs to broken furniture, resets loose drawer pulls and casters. In cans or tubes at Paint, Hardware, 10¢ Stores.



PLASTIC WOOD



Calling All Cars

**MYSTERIOUS DISCOVERY
SAVES UP TO 30%
on GASOLINE
or Costs Nothing to Try**

Stop wasting Gas!—trim dollars off gas bills—get more power—quicker pickup—faster acceleration! AUTO OWNERS everywhere praise VACU-MATIC! Proven so efficient, it is guaranteed to satisfy, or the trial costs you nothing.

Automatic Supercharge Principle
Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing as required. Saves up to 30% on gas costs, with better motor performance.

AGENTS *Get Yours FREE*

FOR INTRODUCING. Here's a splendid opportunity for unusual sales and profits. Every car, truck, tractor owner a prospect. Send name and address now for big money making offer and how you can get yours Free.

The Vacu-matic Co., 7617-489 W. State Street, Wauwatosa, Wis.

Kits for Building Models

(Continued from page 230)

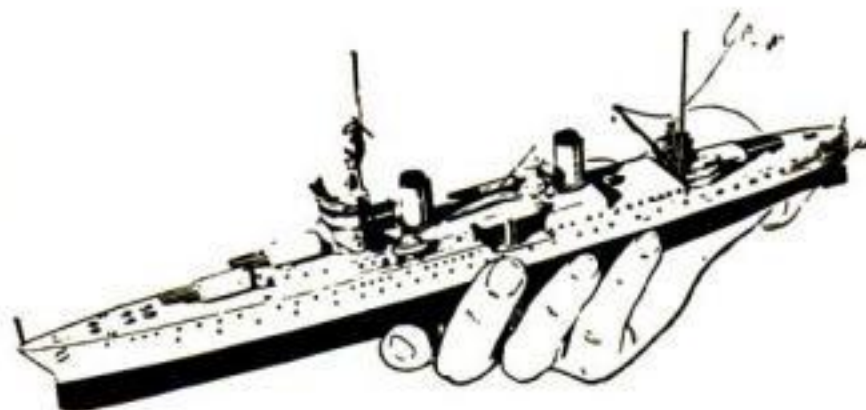
- 11S. Revenue Marine Cutter JOE LANE, a top-sail schooner, 13½" hull, 21" over all (Kit contains precision-shaped hull and finished blocks, deadeyes, belaying pins, etc.)..... 7.00†

MODEL-OF-THE-MONTH KITS

- M. Aircraft carrier SARATOGA, 18" long 1.00
N. Convoy of four U.S. destroyers, each 6¼" long .75
R. U.S. cruiser TUSCALOOSA, 11¾" long..... 1.00
U. HISPANIOLA of the book and movie "Treasure Island," 7" long50
Z. H.M.S. BOUNTY, 8½" hull, 11½" overall.... 1.50
2M. Ocean freighter, 14" long 1.50
3M. Yacht NOURMAHAL, 8½" long 1.00
5M. Liner PRESIDENT LINCOLN, 14¾" long.... 1.50
6M. Fishing Schooner WE'RE HERE of "Captains Courageous," 9½" over all75
7M. Fleet of nine modern U.S. fighting ships, including superdreadnought, light cruiser, aircraft carrier, submarine, and five destroyers; scale, 1" equals 100' 1.50†

SIMPLIFIED SHIP MODEL KITS

- F. Liner S.S. MANHATTAN, 12" long 1.00



Kit H contains all the necessary raw materials for making this 12" model of the "Indianapolis"

- H. Cruiser U.S.S. INDIANAPOLIS, 12" long.... 1.50
J. Clipper SEA WITCH, 9½" hull, 13" over all 1.50

MISCELLANEOUS

7. Whittling kit with two shaped blocks for making sea captain 5½" high 1.50
8. Whittling kit for six different Scotties; each is 2" by 2¼", sawed to shape 1.00
10. Copycraft whittling kit for making one of several Hobo Hank novelties. Includes master model 5¾" high 1.50
12. Marionette kit for making a model of Dopey the Dwarf, 9" high. Ready to assemble 2.25†

Note: If you live west of the Mississippi River or in Canada, add 50 cents to prices marked with an asterisk (*) and 25 cents to prices marked with a dagger (†).

Popular Science Monthly, Dept. 20A
353 Fourth Avenue, New York, N. Y.

Please send me Kit.....for which I
inclose \$.....(or send C.O.D. ☐)

Name

Address

City..... State.....

(Please print your name and address very clearly)

You save the C.O.D. charge by sending your remittance with this order. Remit by money order, check, or registered mail. This offer is made only in the United States and Canada. Canadian orders cannot be sent C.O.D. Also see note above.

Thompson BEATS the World on BOATS

Safe Boats With Full Length Spray Rails

Keep passengers perfectly dry—even at high speeds. Catalog also shows today's five most popular models of sailboats. Two big factories. Prompt shipment.

CATALOG FREE

Write for your copy. State kind of boat in which you are interested.

THOMPSON BROS. BOAT MFG. CO. [94]
219 Ann St. (Write to either place) 119 Elm St.,
PESHTIGO, WIS. CORTLAND, N. Y.

Better Built Lower Prices



Canoes \$66 and up

Rowboats \$42 and up

Outboards \$42 and up

Very fast utility model

BUILD ARC WELDER FROM OLD GENERATOR

For Light or Heavy Work. 75-200 amperes. Complete PLANS and valuable catalog 35c. Over 900 Electrical Supply Bargains.

LeJay Mfg. Co., 1323 LeJay Building, Minneapolis, Minnesota



NEW Grinding Attachment

For 8" to 16" Metal Lathes. Build It Yourself.

At last, a precision grinder within your means. You save 2/3 by finishing our semi-machined castings, on your own lathe. HURON handles both internal and external grinding. Accuracies to .00025". Mirror finish easily obtained. Grinds valves, pistons, bushings, shafts, hard or soft, holes, lathe centers. Sharpens reamers, milling cutters. Does eccentric drilling; lapa; polishes; scores of other uses, for home workshops, garages, machine shops. Write for FREE illustrated folder and full information.

Huron Machine & Tool Co., Dept. C-2, Yale, Mich.



Semi-Machined Castings
Only \$5.95



CASH PAID Why not get ready now to spend spring, summer, fall, outdoors gathering insects—butterflies, moths, I buy hundreds of kinds for collections. Good cash prices paid. Some \$1 to \$7 each. Easy. Simple. Send 10c (not stamps) for *Illustrated Prospectus* before sending any insects. Write today. Hurry!

MR. SINCLAIR, DEALER IN INSECTS
Dept. 59, Box 1830 San Diego, Calif.



GERSTNER Tool Chests

Better, Finer, more Desirable Chests for Machinists and Toolmakers. Free Catalog. GERSTNER TOOL CHESTS
540 Columbia St. Dayton, Ohio

FREE TRAILER BUILDERS' GUIDE AND CATALOG NEW EDITION



World's best line of trailer axles, hitches and parts—Complete house trailer working blue prints only 50c. Write today for this new free catalog.

HAMMER BLOW TOOL COMPANY, Dept. D-2, Wausau, Wis.

DRIVE BY COMPASS



In cold weather especially, wrong turns often lead to treacherous driving over almost impassable roads. You can stay on the right road the year 'round with a Hull Streamline Auto Compass on your windshield. Streamlined Bakelite case, genuine sapphire bearing, built-in compensator. Only \$2.95 at your dealer.

Write for literature.

HULL MANUFACTURING CO.
P.O. Box 246-E2, Warren, Ohio



Print Your Own

Cards, stationery, circulars, tags, labels, advertising, etc. Save money. Print for Others, Big Profits; easy rules sent. Will do popular Raised Printing like Engraving. Junior outfits \$8.25, Senior outfits \$17 and up. Send for free catalog and all details. **KELSEY PRESSES, 5-33, Meriden, Conn.**

BUILD YOUR GRANDFATHER CLOCK

The Simple Sensible Red-i-Kut way as thousands have—SAVE HALF. DIME brings PLANS and sixty picture "HOW" Book written by our engineer pricing many fine brass weight Westminster, tube chime, electric movements showing nine beautiful colonial grandfather cases. **KUEMPEL CHIME CLOCK CO., Bldg. A-17, Guttenberg, Iowa.**



No reason for error with this improved steel tape! Sharp black-on-white markings are easy to read at any time. The crack-proof white surface is bonded to the steel—protects it from rust. Favorite Wyteface is easy to clean, hard to kink, good for a long life. 25, 50, 75, 100 ft. lengths. Mail coupon today for free sample of line and illustrated folder.

K&E FAVORITE WYTEFACE STEEL MEASURING TAPES

LOOK FOR THIS DISPLAY



KEUFFEL & ESSER CO. . . Est. 1867
Dept. 106, Hoboken, N. J.

Name _____
Address _____
City _____ State _____

CLAMPS

You won't have trouble with Genuine "Jorgensen" Handscrews—the jaws won't split, handles won't loosen and threads last indefinitely. Still, they cost no more, so insist on Genuine "Jorgensen" Handscrews... if your dealer can't supply them, write direct.

ADJUSTABLE CLAMP CO.
408 N. Ashland Ave.



PONY Miniatures—9 types 1" to 2 1/2". Fine tools with 100 uses.

"The Clamp Folks"
Chicago, U. S. A.

PONY "50" Fittings go on ordinary 3/4" pipe. Any length. Send \$3.00 plus postage (6 lbs.) for fittings for 2 "50" Clamps. Also "PONY" No. 52 Fittings for 1/2" pipe—2 sets for \$2.00 plus postage.

Catalog FREE



Look for the "Jorgensen" trade mark. It's your guarantee of the best Handscrew made. All sizes. Send \$3.20 plus postage (7 lbs.) for 2 No. 1 Handscrews—open 6".

Sani-Flush CLEANS OUT AUTOMOBILE RADIATORS

SAFE, NOT CAUSTIC

Saw-Filing

Pays up to \$2 or \$3 an Hour in Spare Time

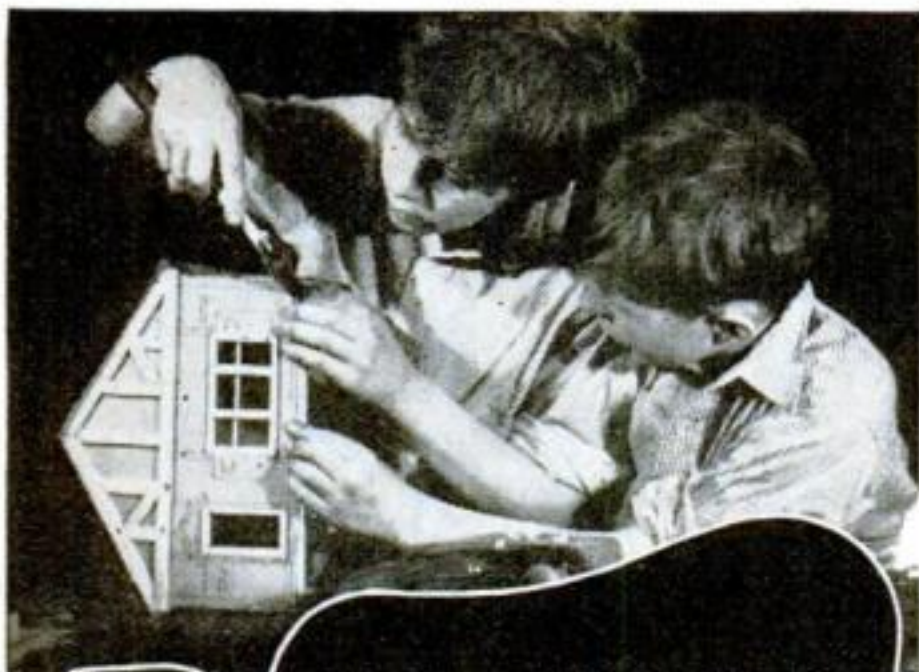
A FOLEY Automatic Saw Filer files hand, circular and band saws better than the best hand filer. Cash business, no canvassing, no eyestrain. No experience needed. Louis P. Wadowick, Ohio, says, "I have filed 764 saws in spare time and have earned \$850.00 in carpenter work due directly to my saw filing contacts." Send coupon for FREE PLAN, no obligation.

FOLEY MFG. CO., 219-40 Foley Bldg., Minneapolis, Minn.

Send Free Plan on Saw Filing business.

Name _____
Address _____





Make MOVIES Your Hobby!

PALM-SIZE
Filmo 8
Makes Movies
at Snapshot Cost!
Only **\$49.50**
\$10 Down

● Make your hobby the most fascinating hobby of all—*home movies*! It's fun! There are unlimited opportunities! And with a Filmo Camera, you get *professional* results with *amateur* ease. For Filmos are precision-built by the makers of Hollywood professional movie equipment.

Just press a button, and *what you see, you get!* It's *that easy!* Palm-size Filmo 8 makes movies in color or black-and-white, indoors and out. Has extra speeds, device for animating cartoons, provision for using special lenses, and other features which make it a basically complete camera that keeps pace with your skill. Only \$49.50. Mail coupon today for free movie booklet. Bell & Howell Company, Chicago; New York; Hollywood; London. *Established 1907.*

NEW 16 MM. FILMO SHELLOADING CAMERA

Eliminates film threading and permits mid-reel changes from color to black-and-white film. With fully color-corrected F 2.7 lens, \$115.



FREE Movie Booklets

BELL & HOWELL COMPANY
1837 Larchmont Ave., Chicago, Ill.

PSM 2-40

Send free, 16-page booklet telling how to make superb movies with () palm-size Filmo 8; () new 16 mm. Shelloading Filmo.

Name.....

Address.....

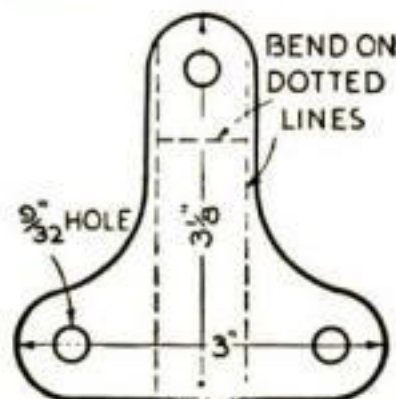
City..... State.....

PRECISION-MADE BY
BELL & HOWELL

Fan Base Holds Camera for Table-Top Shots

FOR table-top photography, a substantial tilting support for the camera may be obtained by using the base of an electric fan. The camera is mounted with a piece cut and shaped as shown.

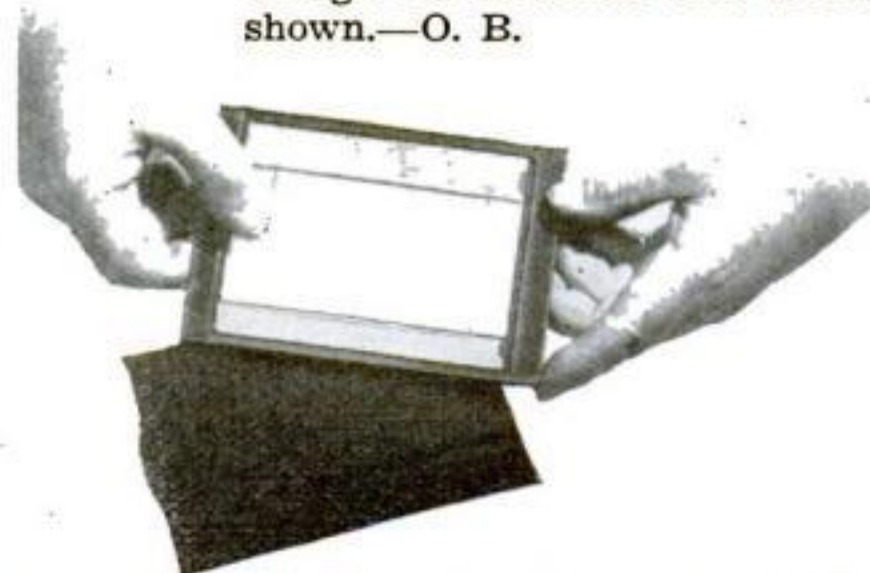
A nickel or chromium-plated auto radiator shell, obtained at any junk yard, provides good material for this.



The base of an electric fan provides a substantial stand for a camera used for table-top work

Cardboard Adapter Keeps Cut Film in Holder

WHEN you lack a cut-film sheath to enable the film to be used in an ordinary metal holder, or if you wish to use a smaller size of film than usual in the holder, cut cardboard to fit the holder and slip two rubber bands over it. Any size film may be held under the bands. The cardboard should be given a matte black color, although for clearness this is not shown.—O. B.



THE argus SPOTTING SCOPE



**55 MM.
OBJECTIVE**

is made entirely of American products largely produced in our own plant in Ann Arbor. Being entirely familiar with the requirements of the shooter and with the leading telescopes now offered, we can assure you that the Argus Telescope will give you what you want at a substantial saving.



ONLY PRECISION INSTRUMENT OF ITS KIND AT THIS PRICE

\$45⁰⁰
less tripod

ARGUS SPOTTING SCOPES ARE GUARANTEED FOR THE LIFE OF THE INSTRUMENT AGAINST DEFECTS IN WORKMANSHIP AND MATERIAL

A BRILLIANT scope, made by the manufacturers of precision-built Argus Candid Cameras. Fine, laboratory-tested optical quality insures accurate results in spotting targets, doping the wind without eyestrain—for all sports activities.

Gives clear, sharp definition of target and hits, 20 times actual size. Spots .22 caliber shots in the black at 200 yards under average light conditions. Regularly equipped with finely corrected 20X eyepiece, or your choice of 12.8X or 26X eyepieces as initial optional equipment at no extra cost. Extra long eye relief and new sloping eyepiece in all powers for those who wear goggles while shooting. Protective metal caps for objective and eyepiece lenses standard equipment. Sturdily constructed for long, hard wear, yet weighs only 43 ounces. Attractively finished in glossy black and black crackle and trimmed in chrome. A handsome leather carrying case is available—many other outstanding features at the low Argus price of \$45.00. For detailed specifications, see chart below.

Objective Lens 55 mm. (or 2-3/16 Inches Clear Aperture)

	Standard 20X Eyepiece	Optional 12.8X Eyepiece \$5 extra	Optional 26X Eyepiece \$5 extra
Eyepiece Power	20X	12.8X	26X
Exit Pupil Diam. in mm.	2.8	4.3	2.1
Relative Brightness	7.9	18.5	4.4
Field of View at 1000 Yards	114 ft. or 38 yards	165 ft. or 55 yards	63 ft. or 21 yards
Eye Relief in mm.	14	11.5	10

Length extended — 14-5/8 inches. Weight — 43 ounces.

MAIL THIS COUPON FOR FURTHER INFORMATION

International Research Corp.
359 Fourth St., Ann Arbor, Mich.



Please send me complete information on Argus Spotting Scope and accessory equipment.

Name _____

Address _____

INTERNATIONAL RESEARCH CORPORATION, ANN ARBOR, MICHIGAN

FEBRUARY, 1940

Please mention POPULAR SCIENCE MONTHLY when writing to advertisers.

235

FIRST STEP to Successful Pictures

Send to "CENTRAL"

GET THIS

Free illustrated catalog listing everything photographic, still and movie cameras, films, lenses, equipment at tremendous savings. Hundreds of bargains new and used—all guaranteed. Liberal trade-ins on cameras and equipment. Write now for free copy of this newest money-saving bargain book—just out. Limited edition. Hurry!

free book
64 pages—
crammed with new and
used bargains



CENTRAL CAMERA CO.
Dept. B-18, 230 So. Wabash
Avenue, Chicago, Illinois

Since
1899

FREE Camera Catalog

YOU SAVE MONEY!

Now—order at home. Select your camera, equipment and supplies from the book that has everything in photography—all the leading names—at real money-saving prices. Amateurs and professionals alike have made this book their photo-buying guide. Send for your **FREE** copy at once. Name and address on a postcard will do.



LAFAYETTE CAMERA

Dept. 98C—100 Sixth Ave., New York, N. Y.



CAPTURE THE COLOR OF LIFE!
YOUR OWN MOVIES! ONLY 10c A DAY!

NATIONALLY ADVERTISED 8MM and 16MM Movie cameras, projectors. For home, business, church, school, club. **MONEY BACK 10 DAY TRIAL.** Payments as low as 10c A DAY. Satisfied customers throughout the world. **FREE** details. **WRITE TODAY.**
Don Elder's Home Movies, Dept. K-2, 739 Boylston St., Boston, Mass.

Send FOR MY NEW BARGAINGRAM NO. 242

A monumental work—lists thousands of STILL Cameras—New and Used... apparatus galore—Slide Projectors—Gigantic Book Section... Chemicals, etc. etc. Also Cine Catalog No. 240—Both **FREE.**

Bass CAMERA CO.

179 W. MADISON ST., CHICAGO, ILL. DEPT. P5



FREE TRAILER PARTS CATALOG

We'll save you money on—axles, springs, wheels, couplers, windows, sinks, water pumps, brakes, refrigerators, beds, lamps, inside and out, 6V lamps, furniture, jacks—everything. Special discount to mfrs. **NATIONAL TRAILER EQUIPMENT CO.** Successors to Kar-A-Van Industries, Inc. Dept. S-5—714 W. Wisconsin Ave., Milwaukee, Wis.

Complete Plans and Building Instructions, 10c

Wood WORKERS
Here it is!



Here is Harold Hunt's latest edition 1940 buyers guide and catalog. Nothing like it ever before published in the history of woodworking—136 pages of vital **FACTS** including new designs, new hints on finishing, many new ideas for experts (AND a new supplementary service showing beginners how to make beautiful furniture the first week)—Experts and Amateurs:

Get this book NOW

Be posted and up-to-date. Read the latest price quotations. See the lists of all Standard American Woods, of ultra-rare foreign woods, the new style of ornaments and inlays AND note the many **astounding bargain deals!** Send only 10c (silver or stamps) to

CRAFTSMAN WOOD SERVICE CO.
3392 Mary Street Chicago, Ill.



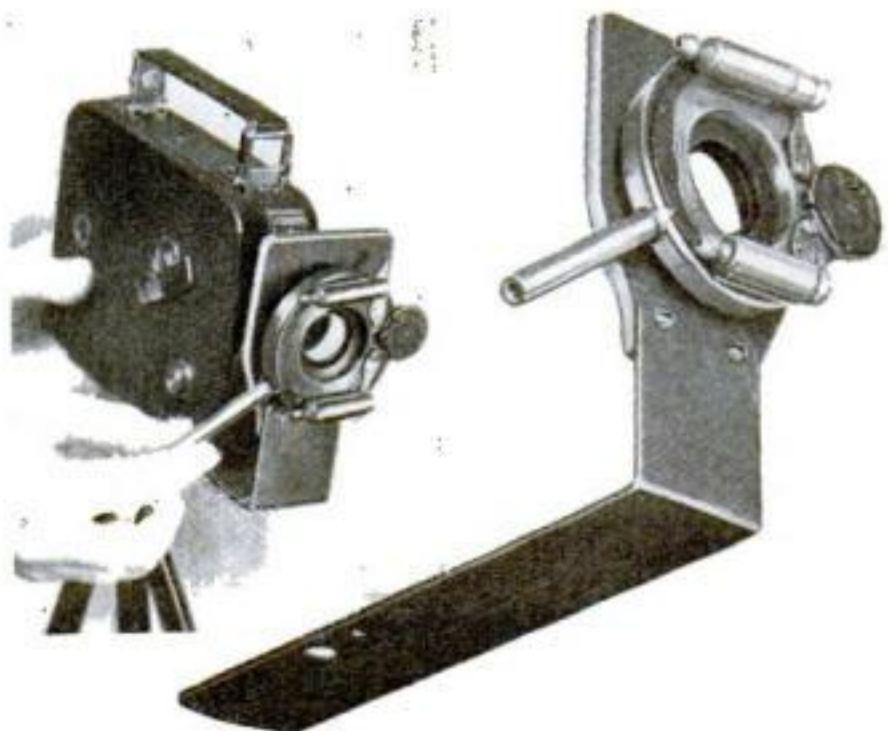
Oiled-Silk Cover Keeps Hypo Free of Dust

WHEN a tank containing fixing solution is left uncovered, it rapidly accumulates a sludge of dust particles, which may cause spots on prints or films. To keep the hypo clear, provide the tank with an oiled-silk cover having an elastic band around the edge, such as those sold for slipping over dishes of food.—**OLIVER BANDELIER.**

Old Camera Diaphragm Fades Movie Scenes

AMATEUR movie makers can easily make fade-ins and fade-outs by mounting the diaphragm from an old camera on a piece of band iron as shown below. A hole is drilled for the tripod screw to enable the device to be held firmly between the camera and the tripod top. A short rod attached to the diaphragm indicator facilitates its operation.

In use, the camera motor is started and the diaphragm opened moderately fast for a fade-in. The procedure is reversed for a fade-out.—**WALTER HOAG.**



Please mention **POPULAR SCIENCE** when writing to advertisers.



TRY THIS NEW GUN ON SMALL GAME AND VERMIN



BARREL SELECTOR

.22 Rifle and .410 Shotgun in ONE!

Price
\$14.95



.22 Cal. Long Rifle Barrel over a .410 Gauge Shotgun Barrel. Barrel selector adjusts mechanism to fire either barrel. Single trigger. Opens like a shotgun, quick to reload. Well balanced. *Ask your dealer to show you one!*
J. Stevens Arms Co., Dept. SM-240, Chicopee Falls, Mass.
Division of Savage Arms Corporation.

New STEVENS NO. 22-410 OVER AND UNDER Rifle and Shotgun



NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

Works off 110 volt electric light circuit. For this unheard of price you can get the marvelous Dynamic Super-Charged Welder complete—all ready to plug into your light socket. The Dynamic does both metallic arc and carbon arc welding.

for Only
\$19.95
RETAIL

Works on Iron, Steel, Tin, Brass, Copper and All Other Metals

You can also solder and braze on the lightest material. With our free instructions you can tackle anything and in no time at all you will be able to do finished repair jobs. Once you have the Dynamic outfit, you are all set in a profitable welding business of your own. Write for FREE particulars TODAY.

DYNAMIC WELDER CO., 2226 - KS, Silverton Road, Chicago, Illinois.

**WELDS BUMPERS,
FENDERS,
CYLINDER BLOCKS,
BODIES, FRAMES, ETC.
Does Farm, Factory
and Home Repairs**

Without previous welding experience you can make for yourself as much as \$5.00 on a repair job that can be done in less than one hour. Many welders make as much as \$15.00 to \$20.00 a day. The Dynamic Welder is light and easily portable.

AGENTS WANTED!

Get our big profit plan and 10-day trial offer. Send for it TODAY.



Send for NEW SHIP MODEL CONSTRUCTION KIT

15¢, coin or stamps, brings you NEW 36-pg. catalog with attractive full-page illustrations, authentic models of historic ships and racing sail boats, with full details of Construction Kits for all models. Remember, for precision-shaped hulls and FINISHED fittings, its

MARINE MODEL CO. 174 WORTH ST. NEW YORK
Dept. S-11



PHOTO ENLARGER \$5.94

Money back guarantee. A REAL Photo Enlarger that does fine work. Focuses automatically. Also COPIES and has a Contact Printer and Retouching Table. Interesting circular free. Only \$5.94 complete. Lens included.

IDEAL-X, 148 West 23 St., New York



Develop and Print Your Own Photos!

The average cost of doing this fascinating work yourself is less than 1½ cents per print. New Thrills—all the photos you want for family and friends at LOW COST! Send today for FREE Bargain Book Cameras and all other photographic equipment, on EASY PAYMENTS at lowest prices.

COMPLETE OUTFIT ONLY \$1.95

Ruby Bulb—2 Enamel Trays—4 Tubes of Universal Developer—½ Pound of Acid Fixer—20 sheets 2¼x4¼ Printing Paper—Glass Stirring Rod—4 oz. Graduate—Thermometer—2¼x4¼ Printing Frame 16 PAGE INSTRUCTION BOOK. Send postcard TODAY! Complete outfit shipped by RETURN MAIL—Pay postman only \$1.95 plus few cents postage on delivery!

UNEEDA, Dept. P-2, 275 Livingston St., Brooklyn, N. Y.



AMAZING NEW ONE MAN PRINT SHOP \$2

PRINTS FROM REAL METAL TYPE, REAL INK, COMES COMPLETE

BOYS

For the first time you can now get a boys' printing press built with parts stamped out like auto bodies—lighter, stronger and cheaper than castings—the idea that makes possible this LOW price.

including substantially-built, ALL-STEEL press, mechanically operated rubber inking roller, 3x3½ inches steel type chase, 138-piece set of 12-point Gothic type, en and em quads, thin spaces, reglets, lock-up screws, ink, paper and step-by-step instructions, easily followed.

Prints TYPE THIS SIZE

with \$2 plus 60c for charges (Pacific Coast, \$2.85). OR, if you prefer, attach \$2 plus 35c postage and SAVE the C. O. D. fee. Extra type 50c.

MONEY BACK GUARANTEE

PECK BROTHERS, 2966 Whitney Ave., Mt. Carmel, Conn.

IT'S NEW-Sensational! ELECTRIC WOOD CARVING

AN EXCLUSIVE HOME FOUNDRY ACHIEVEMENT!

Just plug in a amazing new tool and carve wood by electricity! Set No. E-102: 5 plaques, 3 interchangeable tools: stain, brush and sandpaper. \$2.



Electric Casting Set

Exciting new war molds! Casts 3 large figures; electric casting ladle; vise; 12 pig metal; smoking torch; 2 bottles paint, 2 brushes. Fully equipped electric casting set No. A-104, \$2.

"WONDER PEN"

Electric Wood-Burning New improved pen with ivory bakelite handle and white cord and plug; 12 plaques including book-ends; finishing liquid, water colors, brushes, etc. Complete set No. B-102. \$2.

AT YOUR DEALERS—get Home Foundry Products from your dealer. If he cannot supply you, write to us.

HOME FOUNDRY MFG. CO.

3124 W. Fifth Ave. Dept. S-2 Chicago, Ill.

GET **100 TOOLS in ONE**

Insist on Genuine "MOTO-TOOL"

Grinds, polishes, sharpens, drills, engraves, etc. Saves time, cuts cost. Handiest tool in home or shop...use it daily. Same tool as used on precision jobs in factories.

OVER 25,000 R. P. M. High speed conserves cutters, does finer work. Has oil-less (oil-sealed) bearings, cooling fan, balanced armature, 110 V. (A.C.-D.C.). MODEL 1 MOTO-TOOL with chuck, 1/2" collet, only \$9.85. MASTER MODEL 2, 27,000 r.p.m., heavier, more powerful, only \$16.50.

10-DAY TRIAL. See the genuine Dremel Moto-Tools at better Dealer's or order direct from factory on 10-day money-back trial. Catalog of Dremel tools, equipment and special combination offers, FREE.

DREMEL MFG. CO., Dept. M-120-B, RACINE, WIS.

Only \$9.85 POST PAID MASTER MODEL \$16.50

PRESTO! ANYONE CAN MASTER GLAZE

LEAVES HARD GLASS-LIKE FINISH
EASY TO APPLY
PROTECTS THE SURFACE
NO SMOOR OR STREAKS AS WITH WAX
LASTS SIX MONTHS TO A YEAR

SEALS THE PORES OF THE SURFACE
WILL NOT FINGER-MARK
NO OILY FILM AS WITH POLISH
SAVES YOU MONEY

Car Owners! Meet Master Glaze—the sensationally different luster for new and used cars! Not a wax—not an oil polish—not a paint!—nothing that "smears" over the surface.

MASTER GLAZE is a unique discovery—a creamy liquid—quick and easy to apply! Gives a hard, glass-like surface. Even gasoline cannot dull it! Lasts six months to a year! Amazing luster—beautiful, sparkling clean and brilliant! Doesn't finger-mark—doesn't smear! A match box full glazes an entire car. Seals the pores—protects! NOTHING LIKE IT!

AGENTS
An unusual opportunity! Quick, flashy demonstrator. Big profits. Good territory. Write today!

FREE SAMPLE Write now for FREE BOOK-OFFER. Just send your name and address. Write **MASTER GLAZE CO., 7720-129 W. Harwood Ave., Milwaukee, Wis.**

10 NEW SETS OF STANLEY PLANS

Each set includes five interesting things to make. Complete instructions.

Set No. 1	Hanging Shelves	10c
Set No. 2	Lamps	10c
Set No. 3	Trays	10c
Set No. 4	Tables and Stands	10c
Set No. 5	Book Ends and Small Articles	10c
Set No. 6	Flower Pot Holder and Desk Articles	10c
Set No. 7	Mirrors, Footstool and Table	10c
Set No. 8	Magazine Stands and Tables	10c
Set No. 9	Chests and Boxes	10c
Set No. 10	Smokers' Stands	10c

Select the sets you want; send check, money order or stamps to

STANLEY TOOLS

DIVISION OF THE STANLEY WORKS
222 Elm Street, New Britain, Conn.

YOU CAN MAKE MORE MONEY

In the Composition Novelty Manufacturing Business. Reports of \$100 a week or more are not unusual. Our Big 32-page Book explains the secrets of this profitable business. It's yours for only 10c. Send for it today!

STEWART'S STUDIO, Dept. PS-15, 2927 Wilcox St., Chicago, Ill.

BOAT BLUEPRINTS & PATTERNS

Full size paper patterns! Newest designs by naval architect. Cruisers, runabouts, sloops, snipe, outboard boats, sailing canoe (kayak), etc., 8 ft.-38 ft. Low prices. Rush 10c (coin) for illust. catalog. Send \$1.00 for "HOW TO BUILD BOATS" book.

Cleveland Boat Blueprint Co. Station A-333 Cleveland, Ohio

ITCH STOPPED in a Jiffy -or Money Back

For quick relief from itching of eczema, pimples, athlete's foot, scales, scabies, rashes and other externally caused skin troubles, use world-famous, cooling, antiseptic, liquid D. D. D. Prescription. Greaseless, stainless. Soothes irritation and quickly stops the most intense itching. 35c trial bottle proves it, or money back. Ask your druggist today for **D. D. D. PRESCRIPTION**.

Earn Cash at Home!

We paid M. M. \$1174 for exceptional "cellar crop" SNOW-KING mushrooms! Big free picture book tells if your cellar, shed, barn suitable. We furnish materials, buy all crops thru our 25 branches. Established 1908. Write today. United Co., 3848 Lincoln Ave., Dept. 340, Chicago.

COMB-A-TRIM The New Quick Trimmer

Something New! Trim your hair without any experience. It's easy! The excess hair comes off smoothly and easily by just pulling trimmer through hair like an ordinary comb. Save on hair-cut bills . . . Trim your own hair or the whole family's. Send 49c for your Comb-A-Trim.

Comb-A-Trim Co., 502 Bell Block, Dept. S2, Cincinnati, Ohio

49c

When Writing Advertisers
Please Mention POPULAR SCIENCE

Spindle SHAPER \$3

less cutters (C.O.D. or outside U.S. \$3.25) Postpaid

Make tongue and groove joints; shape mouldings, picture frames, plaques, etc. Limitless projects can be given a professional finish with this shaper. It has 8" x 5 3/4" steel table; stands 5 3/8" high. Uses standard 5/16" hole cutters. (Cutters 55c each.) Oilless bearings. Your fractional H.P. motor runs it.

FREE CATALOG describing \$150 prize contest (1st prize, \$25; 2nd, \$15; 3rd, \$10; 41 other cash and merchandise prizes). Cat. illustr. complete power tool line: Jig Saw, \$1.50; New Jointer, \$6.50; Circ. Saw, \$3; Drill Press, \$2.50; completely equipped Lathes, \$2 & \$1.90; Sander, \$1; etc. Sold direct only. Order today or send card for Catalog.

\$150 PRIZE CONTEST

J & H Metal Products Co. 3 Commercial St. Rochester, N. Y.

The Making of an Army Flyer

(Continued from page 124)

Even swank colonels with eagles on their shoulders had to come in for regular drill in navigation and blind flight.

The cadet in the jeep was having trouble with his turns. The indicating wheel was tracing a snake track as he tried to straighten his course.

"A fellow ought to be able to fly a simple compass heading," criticized Sanders. He had owned a small cabin monoplane at twenty and felt himself an old hand at flying.

Ryan gave him a sidelong glance. "Ever fly under the hood?"

"No, but anybody who has had twenty hours in the air should be able to make ninety and 180-degree turns with his eyes shut. If you keep your ailerons even, it's just like steering a bobsled, only you move your feet the opposite way. What's hard about that?"

The plane leveled itself, the hum stopped, the hood lifted, and "Chubby" McElroy's round head emerged from the cockpit. He mopped a pink face with a handkerchief as he stepped down.

"What's the matter, Lindbergh? Didja get lost at sea?"

"Corrigan, you mean," corrected another cadet. "He started for Philadelphia and landed in a duck pond west of Cincinnati."

"All right," cut in the instructor. "Put 'em back in the hangar, you barracks pilots. Who wants to start on his jeep time?"

"C'mon, Sanders," urged Ryan, with suspicious enthusiasm. "Show the rest of us dodos how to do it."

Sanders grinned confidently, swung a long leg over the cockpit, dropped into the seat; and pulled the "ignition" switch. The fan in the front of the fuselage sent a brisk breeze whistling past his ankles. He clamped the headphones over his ears, swung the hood down tight, and the group at the table heard his "Ready!" from the instructor's headphones.

"Climb to 2,000 feet and make a ninety-degree turn to the left," said the instructor.

The jeep's elevators lifted, the nose pointed upward; the hum of the blower increased. Then soon the jeep leveled off and began to edge to the right as the rudder bent slightly.

G Flight's instructor turned to Rick. "Jones, if he makes a one-needle turn at 130 miles an hour, how long will it take him to turn ninety degrees?"

"Thirty seconds, sir."

"Right. Watch your clock, Sanders."

(Continued on page 241)

LIKE TO FISH?

Shakespeare's WONDEREEL

**LONG CASTS
NO BACKLASHES
NO THUMBING**



Ideal for night fishing and beginners.
3 Wondereels—\$6.50, \$10.00 and \$15.00.

SPECIAL OFFER



GLO-LITE MOUSE

NO THUMBING



☐ New GLO-LITE Mouse Bait. Glows 5 hrs. if exposed 3 min. to sun or flashlight. 50c postpaid (90c value—limited supply). Send cash or stamps.

FREE

☐ 96 page Fishing Guide and Catalog. Write today.

SHAKESPEARE CO., 235 E. Kalamazoo Ave., Kalamazoo, Mich.

Shakespeare *BALANCED TACKLE*

MADE \$1025⁰⁰



in 9 Months
with the

FOLEY LAWN MOWER SHARPENER

"A substantial increase in grind jobs each year, proves beyond any doubt that Foley Grinders do very satisfactory work. We have ground 723 mowers since February 1 to date, November 9. Our total receipts on lawn mower service alone during that period has grossed us \$1,025.00. The prevailing price of grinding and adjusting service is \$1.00 and \$1.25—repairs and parts extra."

—W. A. Tulip, Phoenix, Ariz.

You Too Can Make Big Money

Free plan tells you how to start. The Foley Lawn Mower Sharpener turns out perfect work quickly and easily, no experience needed. Simply put the mower in the machine and turn on the power. Uses same system as lawn mower factories. Sharpens all sizes and types in 15 or 20 minutes.

Special Offer: Attachment for grinding axes, hatchets, knives, etc., included FREE with Foley Lawn Mower Sharpener on our Special Offer, brings you business the year around. Send coupon today.

FOLEY MFG. CO., 208-40 Foley Bldg., Minneapolis, Minn.

Send Free Plan for making money sharpening lawn mowers, and Special Offer on the Foley Lawn Mower Sharpener.

Name

Address



HANNES SCHNEIDER
says...

"If you want to ski well you must practice everlastingly at snowplows and stem turns."

You've got to have good equipment, too, and you'll find that Northland Skis and accessories give you more for your money, bolster up your confidence in skiing. Hannes Schneider, world's No. 1 skier, uses and recommends precision-matched Northlands.

FREE! Illustrated "How To Ski" folder.

NORTHLAND SKI MFG. COMPANY

World's Largest Ski Manufacturers

94 Merriam Park

St. Paul, Minnesota

TEST-O-LITE

Tests Everything Electrical

From 100 to 550 Volts

APPLIANCES

A real necessity for electricians and home because it has 1001 uses. Equipped with a Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, all kinds of electric appliances, etc. Tells A.C. from D.C. Far superior to ordinary clumsy test bulb. Fountain pen size with clip for carrying in vest pocket. Lifetime guarantee.

PATENTED

L. S. BRACH MFG. CORP.

53 Dickerson St.,

Newark, N. J.

\$1.50
At
Elec-
trical
Stores
or
Post-
paid



MOTORS

FUSES

SpeedWay DRILL 7⁹⁵ GRINDER 5⁹⁵

Quality Tools—products of SpeedWay, for 30 years leading manufacturers of electric tools. Specially wound high torque 110V universal tool motors. Improved designs; correct speeds, 1000 RPM Drill with die cast handle has 1/2" capacity in steel. 20,000 RPM Hand GRINDER has speed essential for efficiency and collects for both 1/2" and 3/32" arbors. Drill and Grinder sold singly or together with 5 accessories in fitted Steel Kit. Stand takes either drill or grinder. Router Frame converts grinder into router. Bench Grinder is complete with motor. Adjustable rests, rubber feet and cord. Write for Circulars.

SpeedWay Mfg. Co., 1824 S. 52nd Ave., Cicero Ill.

KIT 14⁹⁵

STAND 3⁹⁵

GRINDER 5⁹⁵

ROUTER 3⁹⁵

HOW TO GET A DAISY Air Rifle

1. Use Your Christmas Cash!

Buy your Daisy with money you got for Christmas. If you've spent it or didn't get any... and have a birthday between now and July 15, listen:

2. WE WILL HELP YOU GET A DAISY FOR YOUR BIRTHDAY! Just do This:

Send us your name, address, date of your next birthday. You'll receive Birthday Reminder Kit 2 weeks before birthday. It's FUN using it—and we hope it helps YOU get a Daisy for your birthday. Write quick!

DAISY MANUFACTURING COMPANY, 552 Union St., Plymouth, Mich., U.S.A.

500
SHOT Repeating
Lightning-Loader
CARBINE
\$2.50 Higher
In Canada

4 lbs. for \$1, postpaid Money-back guarantee

Manufacturers' odd sizes of catalin (phenol resin) the beautiful plastic of modern industry—all colors and mottles.

PLASTICS BARGAIN

Includes rods, sheets, cylinders—in usable sizes, various colors. No two assortments alike but each enormous value. We'll refund payment plus return postage on request. Quantity limited. Order TODAY. Price West of Mississippi \$1.25 to cover extra postage.

CRAFT SERVICE Dept. 103, 360 University Ave., Rochester, New York

YOU HAVE BEEN WAITING TO PAINT

COMPLETE WITH 110 V. MOTOR

ONLY \$9⁸⁵

New Everyone Can Paint This Easy Way—with a Spray Gun!

A complete paint-spraying unit, light and compact, (weighs only 8 lbs.) designed for home use for lacquer, enamel, varnish, insecticides moth-proofing, screens, radiators or furniture. Strictly quality equipment—material and workmanship guaranteed. Complete unit includes high grade 110 V. A.C. D.C. motor, 6 ft. cord and plug, piston type compressor with cast iron cylinder on sturdy base, efficient spray gun with 1/2 pt. glass container and 10 ft. air hose. Write for circular, or Send \$1.00 today—pay postman balance, or shipped postpaid if full price accompanies order. Dealers Write

MILLER SIMONS, INC. 2904 S. 61st Ct. Cicero, Ill.

NEW ROOFS OVER OLD BATTLESHIP

for 3¢ A SQUARE FOOT
ROOF COATING stops leaks permanently. Saves 75% of new roof costs. Guaranteed waterproof. Building Owners: Send for free book—Something New under the Sun. MEN WANTED—A big paying business for salesmen. Write today! No obligation. PANTHER OIL & GREASE MFG. CO. Paint Products Division DEPT. 27, FORT WORTH, TEXAS



GEARS

In Stock—Immediate Delivery

Gears, speed reducers, sprockets, thrust bearings, flexible couplings, pulleys, etc. A complete line is carried in our Chicago stock. Can also quote on special gears of any kind. Send us your blueprints and inquiries. Send 10c for Complete Catalog No. 214

CHICAGO GEAR WORKS 440-48 N. Oakley Blvd. CHICAGO, ILL.

KINKADE GARDEN TRACTOR and Power Lawnmower

A Practical Power Plow and Cultivator for Gardeners, Suburbanites, Florists, Truckers, Nurserymen, Fruit Growers

Low Prices - Easy Terms

American Farm Machine Co.

1072 33rd Av. SE. Minneapolis, Minn.



Choose from World's Largest Line of Power Tools!

FREE New 1940 Catalog covers Metal and Woodworking Tools, accessories, motors for every purse. Write Walker-Turner Co., Inc., 220 South Ave., Plainfield, N. J.

DRIVER Engineered POWER TOOLS



Get Big WELDING PROFITS! with New A.C. Arc Welding

ONLY \$12⁵⁰ MONTHLY

It's easy to establish your own arc welding business! With this complete, new, speedy Hobart A.C. Arc Welder you can handle hundreds of profitable repair and construction jobs. Simple to operate, easy to get high quality welds. Very low operating cost.

HOBART BROS. COMPANY, Box P-240, TROY, OHIO

For as little as \$12.50 monthly you get everything you need to start producing the big profit welding jobs. To prove how profitable it is we give you 10 days trial on your own work, at our risk. Write for your free booklet and complete details.

EARN \$150 to \$300 EXTRA PROFIT MONTHLY

Profit from one job alone pays the small monthly payment!

FREE! "NEW PROFITS IN ARC WELDING"... ASK FOR IT.

Check this ad and MAIL TODAY FOR COMPLETE INFORMATION

The Making of an Army Flyer

(Continued from page 239)

By now the indicator had traced a square turn on the chart. But even as it straightened, it began to edge back again, leftward. In a moment the pilot realized his mistake and corrected it. But soon the rudder shifted back and again he was off to the left. Then, in a few seconds it made an equally wide return to the right. The indicator was tracing a curly spiral on the chart.

"He's tightening up on the turns. Now watch this."

Suddenly the nose jerked quickly to the left as Sanders gave an impatient flip of the rudder bar. Brought up too sharply on a turn, the jeep promptly slipped off and nosed into a spin. Around and around it went, the pilot fanning the air with the controls and vainly trying to pull out.

About the table, grins widened. The instructor bent toward the microphone. "You'll have to neutralize your controls, Sanders. . . . Keep your air speed up—she stalls below sixty-five m.p.h. . . . That's the idea. Now pull her out."

The spin stopped, but in an instant, Sanders was off in the other direction, around and around.

"Well, make up your mind," said the instructor softly. "Are you going to fly it by instrument or by the seat of your pants?"

The jeep's controls shrugged compliance.

"All right. Now pull your rudder over to the right until the compass reads 'East'."

Sanders obeyed and the jeep leveled out into even flight.

"Now how are you getting along?"

"I'm still spinning!" was the startling announcement. G Flight doubled up in silent laughter.

"Well, guess you'd better come down if that's the case," replied the instructor. A moment later a very red-faced cadet lifted the hood. His jaw dropped as he noticed his stationary surroundings.

"Bail out, Sanders, you're going to crash!"

Helpful hands reached up with exaggerated solicitude, to help him down. Sanders waved his arms in surrender.

"All right, all right, I give up! So far as I can see, I'm still in a spin, but I guess maybe those instruments know what they're talking about. Maybe a bobsled is a better proposition for flying by the seat of the pants than an airplane, after all."

Next month, Sterling Gleason will tell how Rick Jones completed his training and received his wings as a full-fledged Army flyer.



FISHING TACKLE at LOW Prices

Send today for New 1940 Catalog listing thousands of bargains in Fishing Tackle, Baseball, Basket Ball, Golf, Tennis, Archery, Guns, Clothing and Sporting Equipment of all kinds. Top quality—**Money Back Guarantee!**

HERE ARE A FEW MONEY-SAVERS

- \$17.50 Bamboo Fly Rod, Alu. Case & 2 Tips \$8.95
- \$9.00 DeLuxe Split Bamboo Fly Rod . . . \$4.95
- \$4.00 Split Bamboo Bait Rod, 9 1/2' extra tip \$2.85
- \$3.00 1-pc. Steel Casting Rod, Offset handle \$1.89
- \$2.75 1-pc. 3 1/2' Split Bamboo Casting Rod \$1.79
- \$3.75 Automatic Fly Rod Reel, light weight \$2.29
- \$6.50 Feather-weight Bamboo Fly Rod, 7 1/2' \$3.95
- \$5.00 Double Tapered 30-yard Fly Line . . \$2.95
- \$1.00 doz. assorted snelled Trout Flies doz. 49¢
- \$1.00 doz. Ringed Trout & Bluegill Flies doz. 49¢
- \$1.00 assorted 6 floating Bass Bugs, 1/0 hook 59¢
- Spalding matched Bobby Jones steel shafted Woods, 1940 models, ea. \$4.95
- Spalding matched Bobby Jones steel shafted Irons, chrome finish, ea. \$3.95

Order any above specials C.O.D. or remit cash. FREE with \$6.50 purchase or more, metal snelled hook holder or metal ribbed sport glasses. Other premiums.

FREE 136-Page Catalog

Yours for the asking. Invaluable to every sportsman. Contains the famous "Fisherman's Calendar."

GATEWAY
SPORTING GOODS CO.
141 Gateway Bldg., Kansas City, Mo.



NEW Electric PRESSER

HANDIEST AID FOR BUSY, THRIFTY WELL GROOMED MEN

Do your own Pressing this modern way, at home, in office or when traveling. Easy to use. No wet cloth, board or bother. Plug in any socket and it's ready to press pants, collars, sleeves, lapels, dress pleats. And man, what it does to crumpled ties! It presses them into crisp newness before you can say Jack Robinson.



Material slides between two electrically heated pressing blades. Saves time, money, wear on clothes. Don't

let another day go by without an Empire. Send the coupon now. And, remember its a gift any man or boy will appreciate. Each Empire presser is fully guaranteed. Comes complete with cord, plug, and simple directions.

DEALERS—Over 750,000 sold to date. Order now to take care of growing demand everywhere.

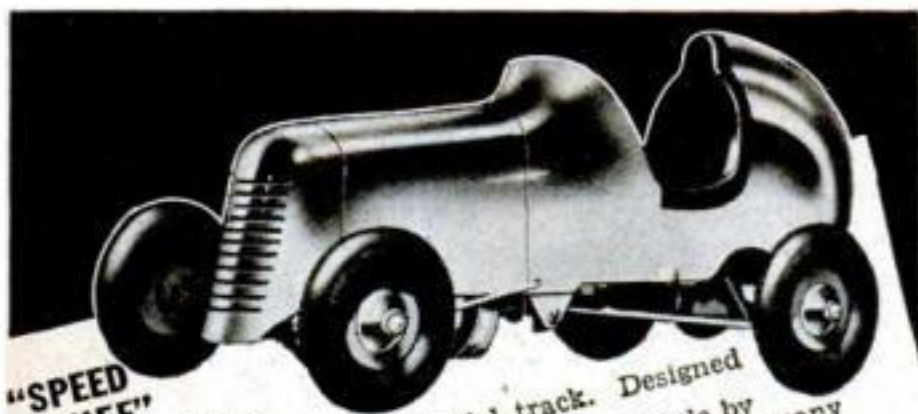
EMPIRE ELECTRIC CO., Dept. PC 817 Main Street, Cincinnati, Ohio

PC-2

Enclosed is \$1.00 for an Empire. If not satisfied, I will return it and my money will be refunded.

Name.....

Address.....



"SPEED CHIEF"

60 Mile an Hour Model Racing Car
 The fastest Racers on any model track. Designed to smash all speed records.
 A beautiful streamline streaking marvel made by a manufacturer of International repute for its many quality products on vast production basis.
 Specifications: Overall length 22½ in. Wheel-base 12½ in. All aluminum castings. Front and Rear. 4-leaved springs. Front wheel steering. Drive shaft, gears run in aluminum wheels. Easy to assemble.
 Built-in Automatic finger-tip clutch control; friction-type clutch. Starts by wheel friction or fly-wheel. Super-speed long life bearings.
 Kit ready for immediate construction with complete plans and all necessary hardware. **\$12.50**
POSTPAID



"Superchief" Sky Chief for Airplanes—Racers—Boats
 A SENSATIONAL 2 CYCLE MOTOR designed for MAXIMUM PERFORMANCE. This Motor has stood the acid test of National competition. A SUPER-QUALITY Motor built to Micro-rigid specifications on large scale production, bringing the price to the unheard of low bracket.
 Bore ¼" Stroke ½" Displacement .525
 Diamond bored micro-lapped bearings. Vibration proof. Non-breakable iron tank. Cast molybdenum cylinder and piston. Takes 13"-14" Prop. Weight App. 10 oz. complete.
BLOCK TESTED—GUARANTEED TO RUN. Complete, assembled, with coil and condenser.

\$6.95
 Postpaid

PARKER INDUSTRIES
 100 W. North Ave., Chicago, Ill.

- ☐ Send RACER KIT C.O.D. \$12.50 plus few cents postage
- ☐ Send "SKY-CHIEF" C.O.D. \$6.95 plus few cents postage
- ☐ I enclose \$12.50 send RACER KIT postage paid
- ☐ I enclose \$6.95 send SKY-CHIEF MOTOR postage paid

NAME _____
 ADDRESS _____

BRONZE FOUNDRY Schools and Home Workshops

Make your own castings of aluminum, copper, bronze, silver. Foundry sets are available in three sizes including 2400 Deg. F. blast Furnaces. \$13.50, \$19.00, \$27.00, f.o.b. Kansas City. Free Circular.

KANSAS CITY SPECIALTIES CO.
 P. O. Box 6022, Dep't S-13 Kansas City, Mo.

HANDEE Hobbies

Get more out of life. Make things with our easy working plans. 75 new, intriguing projects for the home, gifts or to sell—models of ships, planes, houses; engraved glassware, trays, mirrors; statuettes, book ends, etc. Portfolio of 12 plans, 25c.

TOOL OF 1001 USES

A tool shop and power house in one. Plugs in any electric socket. Grinds, drills, polishes, cuts, carves, routs, saws, sands, sharpens, engraves, all materials. Write for FREE 64-page catalog. Shows Handees \$10.75 up.

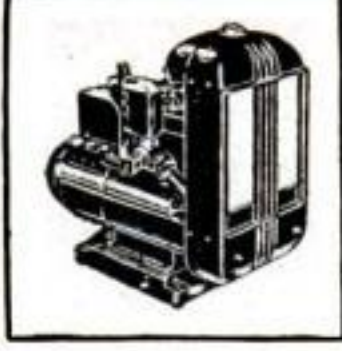
CHICAGO WHEEL & MFG. CO.
 115-S Aberdeen St.
 Chicago, Illinois



10 Days Free Trial

ELECTRICITY

FROM YOUR OWN ELECTRIC PLANT
 WHEN POWER LINES FAIL



ONAN ELECTRIC PLANTS furnish 110 Volt, 60 Cycle, A.C. Current same as City Power Lines. Models for Farms, Camps, Construction Jobs and for Emergency Service in Hospitals, Schools, Theatres and Public Buildings. **SAVE PROPERTY** and even **LIVES** in case of Power Line Failure. Thousands in use in all parts of the World. Operate Lights, Radios, Water Systems, all Appliances. New Models 350 to 50,000 Watts. 12, 32 and 110 Volt, D.C.—110 and 220 Volt A.C. Also Combination A.C.-D.C. Units. Manual, Self-starting and Full-automatic Starting Types. \$99 and up. Shipped **COMPLETE—READY TO RUN**. Write for Details.

D. W. ONAN & SONS
 1697 Royalston Ave. Minneapolis, Minn.

FLEXIBLE...

transparent, waterproof

● Holds permanently on china, glass, wood, metal, leather, paper, fabrics. Not affected by heat, cold, moisture. Dries quickly. Ideal for model making, as well as for mending.



DUCO CEMENT

ENGINES

A real money maker for farm or factory. Uses Cheap fuels. Pays for itself out of savings. Costs Less to Own—Less to Operate.



LOG SAWS

Make Money—Start a wood sawing business—turn spare timber into cash. Cash or Terms—Engine and Saw Catalog. 2222 OAKLAND AVE. KANSAS CITY, MO.

WITTE ENGINE WORKS

MENDS MOST ANYTHING

Iron Glue holds tight, is extra strong. You can buy it 'most anywhere—¼ pt. to 1 gal. cans or 10c bottles. **FREE:** Send post card for booklet, "Better Results with Glue," to: McCormick Sales Co., 404 Light St., Baltimore, Md.

IRON GLUE AN ELEPHANT FOR STRENGTH



MODEL SHIP & YACHT FITTINGS

Carved Hull Kits—Bluenose, Niagara, Swallow, Trawler. Construction sets for all popular models. Model Yacht fittings, sails and spinnakers—used by leading model yachtsmen everywhere.

We manufacture the largest and finest line of model fittings anywhere. Send 20c (coin) for 44 page illustrated catalog No. 15. Shows hundreds of items you need.

A. J. FISHER
 1002-B Etowah Ave., Royal Oak, Mich.



New 1940 WOODWORKERS Catalog

Latest, most complete list of rare woods in lumber, veneer, mouldings, plywood—at attractive money-saving prices. Finest list of inlays ever offered—with inlay pictures and kits. Full line of cabinet hardware and workshop accessories. Send only 10¢ for this big book of valuable craft information.

Woodcraft Supply Company—415 N. Hoyne—Chicago, Ill.



600 Miles an Hour in the Air

(Continued from page 104)

heavily in the reduction of this variety of drag.

Rivets, for example. High-speed wind-tunnel tests have shown that the usual number of 3/32-inch brazier-head rivets in a metal wing increase its drag by twenty-seven percent if they are exposed, but increase it by only six percent if they are countersunk. Spot-welding causes even less drag, provided that the depressions at the welds are kept as shallow as possible. Conventional lapped joints are responsible for a nine-percent increase in wing drag, but if the joints are joggled they cause only four percent more drag than a perfectly smooth wing. Manufacturing irregularities, such as waviness in the metal sheets and joint imperfections, cause an eight-percent increase in drag. Paint sprayed on the wings of a certain plane increased its drag at 225 miles an hour by fourteen percent.

In their desire to increase the speed of airplane flight, scientists haven't lost sight of the necessity for increasing their safety. Continuous investigations are conducted with the purpose of making it possible for designers to produce planes with improved stability and control.

Many experiments for this purpose are made in the twelve-foot, free-spinning wind tunnel at Langley Field. Models are launched in a tail spin in the rising air stream. After the spin has fully developed, a clockwork mechanism in the model sets the controls for recovery and the model's action is recorded by a motion-picture camera. These tests make it possible, before a plane is built, to determine whether it will be controllable.

Until a few years ago, the United States was the world's undisputed leader in aeronautical research, but since 1935 the emphasis placed on flight investigation by Germany and Italy has enabled them to catch up with us and perhaps forge ahead of us. Germany has a 600-mile-an-hour, full-scale wind tunnel at the great research center at Adlershof—Eaglecourt—which employs four times the personnel of our Langley Field laboratories, and has three other major research centers. Italy also has a marvelous laboratory in Guidonia, a new city devoted entirely to aeronautical research. With the appropriation by Congress of \$10,000,000 for a new N.A.C.A. flight laboratory at Sunnyvale, Calif., to supplement the work being done at Langley Field, Uncle Sam is making a new bid for military and commercial supremacy in the air.



Prices
F.O.B.
Factory

**EVINRUDE
"MATE"**

Weights only
10 pounds

Costs only
2¢ an hr.
to run

The lowest price . . .
the biggest value . . . in
Evinrude history!

A smart and capable outboard offering all of Evinrude's famed features — Hooded Power — Co-Pilot steering — finger-tip controls — Underwater Silencing — trouble-proof Centrifugal Pump Cooling — extraordinary starting ease — a complete 1940 Evinrude for only \$29.95! Fits any boat . . . a great motor for fishermen . . . runs all day on a gallon of fuel!

WRITE FOR 1940 CATALOG — FREE!

New catalog describes complete line of nine 1940 models, including sensational new 4-cylinder "Zephyr"—thrillingly smooth 4-cylinder performance with light weight and low cost. Also catalog of 1940 Elto models, with prices starting at \$26.50. Write today. Address, **EVINRUDE MOTORS**, 4305 North 27th Street, Milwaukee, Wisconsin.

SHIP MODEL BUILDERS

Send your problems to us. Our model consultant can help you whether beginner or old hand. We have a complete department of ship models, model kits, and scale fittings.

Write to Ship Model Department

JAMES BLISS & CO., INC.
220 State Street

Est. 1832
Boston, Mass.



**Agents and Dealers WANTED
to Sell or Rent the NEW**

**AMAZING
LOW
PRICES!**
Buy Direct
From Mead

**MEAD Ranger
SCOOTER**



These sensational, new, improved Ranger Scooters sell like hot cakes all over the country! Order your demonstrator while territory is still open—there's big money selling to all stores needing quick, cheap delivery . . . sell to messengers, mechanics, garages, canvassers, friends; or rent for easy hourly profits at beaches, resorts, etc. World's CHEAPEST transportation! 120 miles per gallon. 35 m.p.h. Low prices buying DIRECT from Mead. MEAD'S New Ranger STEEL frame, 2-speed gear, 1½ or 2¼ H.P. Solomodels, tandem, delivery, sidecar or trailer HURRY! Write for FREE SCOOTER Circular, Easy Terms. (Bicycle Circular Free on request.)

**CYCLE CO.
Mead**

17 So. Market, Dept. A-2, Chicago, U. S. A.

**AMERICA'S MOST
FAMOUS CYCLE NAME
FOR FIFTY YEARS**



GOOD TOOLS NEED GOOD OIL

When you work with tools, they must be in working condition. 3-IN-ONE Oil keeps tools clean and bright. It oils the working parts; protects against harmful rust and tarnish. Get it at Hardware, Drug, Grocery, 10¢ Stores.



3-IN-ONE Oil



Chemical Catalog FREE 40 Big Bargain Pages

Of Laboratory Supplies, Apparatus, Chemicals, Scientific Books, Telescopes, Microscopes, Biological Needs. Save Money! Buy direct. Send Now. It's FREE. Full of Bargains & valuable information.

J. H. WINN MFG. CO., Dept. 102, 124 W. 23 St., N.Y.

FREE CHEMISTRY BOOK

Big valuable laboratory catalog easily worth 25¢—FREE—listing thousands of C. P. chemicals, apparatus, microscopes, scientific books, biological and laboratory supplies. Items as low as 5¢. Equipment for complete industrial, professional and home laboratories at bargain prices. Save money! Just write post card—for a short time only there will be no mailing charge. Get your copy of handbook NOW!

KEMKIT SCIENTIFIC CORP.

397A Bridge St.

Brooklyn, New York

\$2.50 POSTPAID—19" KIT U. S. SUBMARINE

SCALE MODEL

Water ballast chamber and air control valve for diving. Runs on surface or underwater. 54 parts ready to assemble. Die cast conning tower, naval gun, keel parts. 19 inch Model completely assembled in navy colors.....\$3.50 P. P.
13 inch Model completely assembled.....\$1.75 P. P.
13 inch Kit, 40 parts.....\$1.25 P. P. Send 3c for catalog of other models

WESTLAKE MODEL CO., DEPT. PS-24, ERIE, PA.



DON'T THROW FURNITURE, mirrors, glassware, etc. away...repair them with Rogers Glue—makes them as good as new...Rogers Glue is ready to use and works quickly—stays put longer because it is stronger. Sells 10c and up in tube, jar or can at hardware stores only or send 10c for full size jar and you receive a Free Project Book giving new ideas, new plans for making useful articles—to Dept. B. ROGERS GLUE COMPANY Gloucester, Mass.



ROGERS

the best LIQUID FISH GLUE

Gus Shockproofs a Car

(Continued from page 144)

a steady one. Very much obliged to you."

Joe Kent, an out-of-town salesman who waits, whenever he can, until he gets to the Model Garage to have his repair work done, was the next caller. "I don't know what's the matter with this bus of mine," he complained. "It's running all right, but it burns up almost as much oil as it does gasoline. I've lost almost two quarts in a hundred-mile run today.

"I've got a few calls to make in town, and I'd better make them now," Kent said. "I'll come back when I've finished. But I wish you'd take a look at my windshield wiper right now. It isn't working well, and it's starting to rain."

Gus looked the wiper over and then disconnected the vacuum line at the manifold. Then he grinned. "Guess I brought down two birds with one shot," he said. "Your vacuum line is filled with oil—that's why your wiper doesn't work right, and also why you are using so much oil. The diaphragm of the booster pump that makes the wiper work at a uniform rate of speed is broken, and the oil is being drawn right into the intake manifold. I'll connect your wiper direct to the manifold now, so it will work all right for this afternoon. When you bring the car back I'll put a new diaphragm in the booster pump, and your oil trouble will be over."

After Kent had driven away Joe Clark came into the shop to collect time and material slips. He frowned as he glanced over the sheaf of them that Gus handed him. "All little picayune jobs," he grumbled. "Well, that's the way in the garage business—just one darn thing after another."

"Sure," Gus said. "That's why I like it."

POPULAR SCIENCE Question Bee

ALL RIGHT, let's see how well you came out in the Question Bee on page 140. The letters in the list below indicate the correct answers to the numbered questions. Check your results with the list and give yourself five points for every one you had right. A total score of 75 to 85 is good, and 90 or better is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. c | 5. d | 9. b | 13. c | 17. a |
| 2. b | 6. a | 10. b | 14. c | 18. c |
| 3. b | 7. c | 11. c | 15. c | 19. b |
| 4. d | 8. d | 12. b | 16. d | 20. b |

504

This One



DFYA-629-6QHW

Table-Top Oil Refinery

(Continued from page 211)

gone well, you will find that the oil has thickened considerably or has actually turned solid—depending on the degree of activity of your homemade catalyst, and other conditions in carrying out the experiment.

You can make your product a little purer by filtering it, while hot, through a pledget of absorbent cotton placed in a funnel. This removes the nickel catalyst mixed with it. Both the oil and the funnel must be warm during this filtration, or the oil will harden in the funnel and refuse to flow.

Another oil that lends itself to home-chemistry experiments is the oil from the seed of the flax plant, or linseed oil. Used in making paints, linoleum, printing inks, and putty, linseed oil has the unusual ability to combine with the oxygen of the air and form a stiff, rubberlike film. The thick scum or skin that you see on the surface of paint in a can is a film produced by the oxidation of linseed or other oils of the paint, forming compounds that are termed linoxins.

You can easily show how such an oil combines with the oxygen of the air, and at the same time demonstrate the first step in the manufacture of linoleum. Cut several pieces of cotton cloth, an inch or more wide and six or eight inches long. Hang the strips vertically in a warm place, with a noncombustible tray beneath them. Pour linseed oil over the strips, letting it trickle down and saturate the cloth. To each fluid ounce of the linseed oil that you apply, there should previously have been added several drops of a liquid drier (a metallic resinate or borate), which may be obtained at any paint store. The drier acts as a catalyst to speed up the oxidation of the linseed oil film. At the end of several days or weeks, the cotton strips will be so stiff that they can be held horizontally by one end without drooping.

By repeated treatments of this kind, the cloth may be given a thick layer of oxidized oil or linoxins. In making linoleum, such strips are prepared in warm buildings; the strips are ground; gums, resins, coloring pigments, and cork dust are added; and the whole is fabricated into sheets of linoleum for your kitchen and other floors.

Linseed oil also combines with sulphur, as do other vegetable oils, notably rapeseed oil. A rubbery product is the result. Try heating a tablespoonful of linseed oil with a pinch of ordinary flowers of sulphur, stirring until the sulphur has melted. The mass can be drawn out like rubber and even has the odor of rubber. Under the name of "factice," it is used as a rubber substitute.

Please mention POPULAR SCIENCE when writing to advertisers.

"THE RIGHT SAW FOR Every Job"



• Using the right type of saw plays an important part in giving work that master-craftsman touch... and makes every job a lot easier. Equip your work bench with Atkins Saws of enduring Silver Steel. They give you the "edge" for perfect workmanship. See them at your local hardware store. Send 10c for How-To-Do-It Book.

ATKINS *Silver Steel* SAWS

"For Every Cutting Job — Atkins Has The Edge"
E.C. ATKINS AND COMPANY, 428 S. Illinois St., Dept. S-2, Indianapolis, Ind.

NEW STREAMLINE BENJAMIN AIR RIFLES

WITH LEVER
HAND PUMP



BENJAMIN

HARD ACCURATE SHOOTING WITH CHAMBERED AIR
You can use new models BENJAMIN AIR RIFLE WITH LEVER HAND PUMP anywhere, for practice firing or just plinking around the house or camping, fishing, hunting, etc., at lowest cost. Shooting force is adjustable depending on AIR PRESSURE—amazing maximum power and accuracy—will penetrate to 1". Hair trigger firing without lunge or recoil. Single Shot BB \$7.50. Repeater BB \$9.00. Rifled Cal. 22 or 177 Single Shot \$8.50. Ask your dealer all about them or write for complete specifications—targets and blueprints FREE if requested. We also make a complete line of BENJAMIN AIR PISTOLS for target and small game. WRITE TODAY. BENJAMIN AIR RIFLE CO., 893 MARION ST., ST. LOUIS, MO., U. S. A.



AT LAST!

A COMBINATION HI-SPEED WOOD PLANER and FINISHER

FITS ANY
DRILL PRESS
\$7.50

COMPLETE



■ This sensational, time-saving, absolutely accurate, automatic wood planer and finisher eliminates need for hand planing and sanding. Works like a charm in any high speed table or pedestal drill press. Parallels and surfaces perfectly—finishes knots, grains and surrounding surfaces to agree smoothness—will not mark, scratch, gouge or check. A life time precision tool for precision work—safe, easy to operate—accurate to within .001 of an inch.

FREE TRIAL GUARANTEE Send check or money order for \$7.50—or order C.O.D. We guarantee 100% satisfaction or your money will be refunded promptly—no strings attached.

FREE LITERATURE • DEALER OPENINGS

BERRY TOOL COMPANY

310 Architects Bldg.

Detroit, Michigan



EXPLORE NATURE'S WONDERS WITH THIS MICROSCOPE

Fly's Foot

Start a Fascinating Hobby Now!
—a hobby that reveals all of Nature's wonders! This optically fine 425-power Wollensak Microscope reveals thousands of Nature's hidden life forms—some beautiful; others horrid and monstrous. You see them clearly, sharply, in detail. Magnifies from 100 to 425 diameters, in steps of 25. \$20. 150-power at \$14.50. Stores or direct, postpaid (or C.O.D.). **WRITE FOR FREE BOOK!**

425 POWER \$20

Wollensak Optical Co., 800 Hudson Ave., Rochester, N. Y.

WOLLENSAK

PAINT STRIPING TOOL

AS EASY TO USE AS A PENCIL!

ONLY \$1.00 POST PAID

With this new low priced tool, you can now do professional striping—on furniture, autos, models, tiled walls, toys, boats—and all home workshop projects. Tool uses paint, enamel, lacquer, etc. Thousands of satisfied users in home, workshops, garages, furniture stores, etc. (We also make commercial and industrial models.) Send only \$1.00 for complete tool with gravity feed container, 1/16" striping wheel, adjustable guide, operating instructions, etc. Sold on Money Back Guarantee. Narrower or wider stripe widths available. Write today for free literature.



stripes add beauty to every painted article

Dealers: Write for catalog, prices and discounts.

WENDELL MFG. CO.
2550 N. Ashland Ave. Chicago, Ill.

Balance as above with 1-50; 1-20; 2-10; 1-5 and 2-2 gram weights **\$4.75**
base 6 3/4" x 3 1/2"

Catalog with 3,000 illustrations of laboratory apparatus sent for 50c. Wholesale price list 1,000 illustrations, 10c.

LABORATORY MATERIALS CO., 7319 Vincennes Ave., Chicago, Illinois

Briar Hill STOKER PIPE
THE ONLY PIPE THAT REALLY **STAYS LIT**
BURNS ALL THE TOBACCO

\$1.50 GENUINE IMPORTED BRIAR

SEND FOR **FREE CATALOG**

BRIAR HILL CORP., 32 Jackson St., MILLERSBURG, OHIO



100 POWER TELESCOPE COMPLETE LENS KIT only \$1.95

Make your own high powered telescope in one evening of easy work. All optical parts completely finished for 6 ft. long refracting telescope. Kit contains 3" diameter 75" F.L. ground and polished objective lens and 2 astronomical eyepieces 50X and 100X. Here is your chance to own a high powered telescope and study the mountains and craters on the moon, the ringed planet Saturn, the moons of Jupiter, double stars, and hundreds of other interesting sights. Complete kit with full directions for mounting, only \$1.95 postpaid. Send money order now for immediate delivery.

BROWSCOPE CO. Dept. 62 5 W. 27th St., New York

Your Microscope Reveals Secrets in Stone

(Continued from page 208)

more complex, but the beautiful results obtainable with most rock materials will justify the effort. It may sound strange to talk about sections of rock thin enough to transmit light, but even the blackest, densest rock, when reduced to a thickness of 1/1,000" or so, will pass light, and even permit print to be read through it. In this state it makes an excellent subject for microscope study. Much of our present-day knowledge of rock structure was made possible by such thin sections.

At first, you will find it best to select some crystalline material such as a piece of granite, for the reason that the various minerals (quartz, feldspar, etc.) are beautifully differentiated in polarized light.

Take a fragment of rock that is flat and rather thin, and cement its flattest surface to a piece of sheet mica, say one measuring 3/4" by 1", with hot balsam. Place a drop or two of balsam in the center of a glass slide and heat it gently over a Bunsen or alcohol flame. Do not heat it enough to cause violent bubbling. After a minute or so, let the balsam cool. If you can dent it easily with your finger nail, it requires a little more heating. If you can barely make an impression in it, it is about right. If the heating is carried too far, the balsam is brittle, and some unheated balsam must be added to restore the solvent.

After the finger-nail test indicates that the balsam is right, remelt it and cement the rock fragment to the mica plate. Then fasten the mica to the slide. The purpose of this mica plate will become apparent presently.

For grinding the specimen flat and polishing it, you will need abrasive stones of several degrees of fineness. A workable combination consists of a coarse-grained stone, say a piece of sandstone of the type used for making grinding wheels or grindstones, and a two-faced razor hone. Keep the stones wet while you are grinding the section. A hose arranged to give a steady flow of water across the face of the abrasive stone is excellent.

First grind the specimen flat and reduce it to the thickness desired, on the coarse abrasive surface. Next use the coarser side of the razor hone, and finally polish it on the finer side of the hone. Use straight back-and-forth strokes. Rocking that produces a convex surface on the specimen can be reduced by cementing, with balsam, two

(Continued on page 247)

"HEAP BIG NEW BOAT READY!"

HOLD 'UM 4 BIG PALEFACES! CARRY HIM ON SHOULDER! USE 'UM BANG! BANG! MOTOR UP TO 9 PONY-POWER! OARS & SAIL!

WEIGHS ONLY 75 LBS.

Chief Eaglebeak



OARS and OARLOCKS now INCLUDED with your OK-4 kit!

The Biggest, Lightest, and

Strongest Boat of Its Kind!

BIG MONEY ASSEMBLING NEW OK-4! IN A FEW EVENINGS AT HOME!



OK-4 is ideal for Sportsman! Light, long strong and roomy!



Even with 4 passengers, a light weight motor gives plenty of power!



Here's OK-4 speeding along with a 9 horsepower motor.



The new 75 lb. OK-4 easily lifted to car-top. Portable!



Two girls easily launch this sensational 14 footer!

Everybody—even grumpy old Chief Eaglebeak—is mighty excited over Mead's big, new 14-foot portable Outboard KI-YAK! Think of it!—ANYONE, without previous experience, can build OK-4 at home in a few evenings and save nearly HALF the factory-built cost—or sell to others at Big Profit! And get these startling OK-4 features: Carries 4 adults comfortably, and duffie—takes motors 9 h.p. or less, oars and sail—weighs only about 75 pounds for easy portability on shoulders or car-top for fishing, camping, touring, hunting. Seaworthy. Leakproof. Durable. Double canvas bottom for double-safety! The biggest, lightest, strongest boat of its kind—AND—made only by MEAD—in knockdown kits for quick home-assembly, or factory-built, ready for the water. Rush dime for Chief Eaglebeak's big illustrated Circular, amazing Low Factory-To-You Prices! Oars and oarlocks now INCLUDED with your OK-4 Kit—hurry!

OK-4 HIM OK BUILD 'UM EASY!



4 OTHER GREAT KI-YAKS

A Mead for every need! Paddle-and-sail-models! The sturdy "CK-1" 10 footer, 20 pounder! The Sportsman's 30 lb. CK-2! The "Big bad CK-3" with 90 square feet of sail on 45 pounds of boat—the sailor's delight! Then there's the 50 pound "OK-2"—Spitfire Of The Fleet—takes up to 4 1/2 h.p. motor, oars, sail! and REMEMBER—Mead is America's largest Ki-Yak manufacturer—so buy your Ki-Yak Kit from HEADQUARTERS. Rush Coupon and dime now!

Double Blade Paddle or OARS INCLUDED with each Kit!



5 1/2 Year Old Carries CK-1

←CK-3
CK-2→



The 50 Lb. OK-2—Uses Oars, Motor, Sail Rig.

"MAIL 'UM COUPON!"



To: CHIEF EAGLEBEAK
c/o MEAD GLIDERS,
15 So. Market, Dept. D-20, CHICAGO

Rush 'um new KI-YAK Boat Circulars! Me much interested in heap low Factory Prices. I enclose 10c postage, packing charge. (Please PRINT plainly.)

Name _____
St. and No. _____
City _____ State _____

MEAD GLIDERS

15 S. MARKET ST.

DEPT. D-20

CHICAGO, U.S.A.



At left: ACTUAL COLOR PHOTOGRAPH. James Callis, N. Carolina farmer, shows Agnes Williams—from near-by farm—a tobacco plant in flower, from the crop he has raised by Government methods.

Copyright 1946, The American Tobacco Company

"UNCLE SAM'S

new ideas helped make tobacco better than ever

*..and Luckies bought the top-notch grades!"
says Luther Herring, 12 years a buyer!*

Q. "You say Uncle Sam helped tobacco farmers?"

MR. HERRING: "Yes. Even though crops vary with weather, U. S. Government methods have made tobacco better than ever during the past few years."

Q. "And Luckies get this better tobacco?"

MR. H: "Luckies buy the finer grades, and always did."

Q. "That's a strong statement."

MR. H: "Well, I see first hand that they buy the prettier lots of tobacco. That's why Luckies are the 2-to-1 favorite with independent tobacco men. And that's why I've smoked them myself for 21 years." Try Luckies for a week. You'll find they're easy on your throat—because the "Toasting" process takes out certain harsh throat irritants found in all tobacco. You'll also find out why—

**WITH MEN WHO KNOW TOBACCO BEST
—IT'S LUCKIES 2 TO 1**

